76-02/

76-02(D)

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TYPE 76-02 OR 76-02 (D)
DUAL-TRACE PLUG-IN
INSTRUCTION MANUAL

Serial No.....

The following pages of this Plug-in Module manual contain the text, parts list, and schematics designed for use with the Du Mont Type 765 Family of Oscilloscopes.

Insert these pages into the binder you received with the Type 765 Series Instruction Manual so that you will have a complete Instruction Manual for your oscilloscope.

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963 Fairchild Camera and Instrument Corp.

Assembled Manual No. 6704 0983

DU MONT

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TABLE OF CONTENTS

Section	Title	Page
1.	**OPERATING INSTRUCTIONS**	
1-1	Introduction	1-1
1-2	Technical Summary	1-1
1-3	First-Time Operation	1-2
1-4	Applying a Signal	1-2
1-5	Dual Trace Operation	1-3
1-6	Use of Probes	1-4
1-7	Input Coupling Selection	1-4
1-8	Obtaining a Display	1-4
1-9	Additional Hints	1-5
1-10	DC Bal Adjustment	1-5
1-11	Gain Adjustment	1-5
1-12	Voltage Measurements	1-5
1-13	Dual-Trace Triggering	1-7
1-14	Dual X-Y Displays	1-7
2.	**MAINTENANCE AND RECALIBRATION**	
2-1	Introduction	2-0
2-2	Input Amplifier Circuit Description	2-0
2-3	Electronic Switch Circuit Description	2-2
2-4	Common Deflection Amplifier	2-2
2-5	Location of Replaceable Components	2-3
2-6	Servicing Hints	2-3
2-7	Gaining Access to Chassis	2-3
2-8	Test Equipment Required for Service Adjustments	2-4
2-9	DC Bal Adjustments (Channels A & B)	2-5
2-10	A & B Gain Adj	2-5
2-11	High Frequency Trimmer Adjustments	2-5
2-12	Trig DC Level	2-5
2-13	Input Capacitance Standardization and Attenuator Adjustment	2-5
3.	**PERFORMANCE ASSURANCE TEST**	
3-1	Maintenance Check to Assure Performance	3-1
3-2	Test Equipment Required	3-1
3-3	Checking Sensitivity	3-1
3-4	Checking Fast Rise	3-1
3-5	Checking Bandwidth	3-1
4.	**ELECTRICAL PARTS LIST AND SCHEMATICS**	4-1

List of Recommended Vendors

TABLES

Number	Title	Page
1-1	Technical Summary, Du Mont Type 76-02 or 76-02 (D) Dual Trace Plug-in	1-1
2-1	Attenuator Compensation Trimmers	2-8

ILLUSTRATIONS

Figure	Title	Page
1-1	Du Mont Type 76-02 or 76-02 (D) Dual Trace, Wide Band, High Gain Plug-in	1-0
1-2	Function of Controls and Connectors	1-3
1-3	Peak-to-Peak Voltage Measurements	1-6
1-4	Instantaneous Voltage Measurement with Respect to Ground	1-7
2-1	Dual Trace, Input Amplifier Functional Block Diagram	2-0
2-2	Dual Trace, Electronic Switching Circuit Functional Block Diagram	2-1
2-3	Dual Trace Driver Amplifier Functional Block Diagram	2-3
2-4	Identification of Replaceable Parts (Right Side View)	2-6
2-5a	Identification of Replaceable Parts (Left Side View)	2-7
2-5b	Identification of Replaceable Parts (Left Side View)	2-7
4-1	Identification of Replaceable Parts	4-0

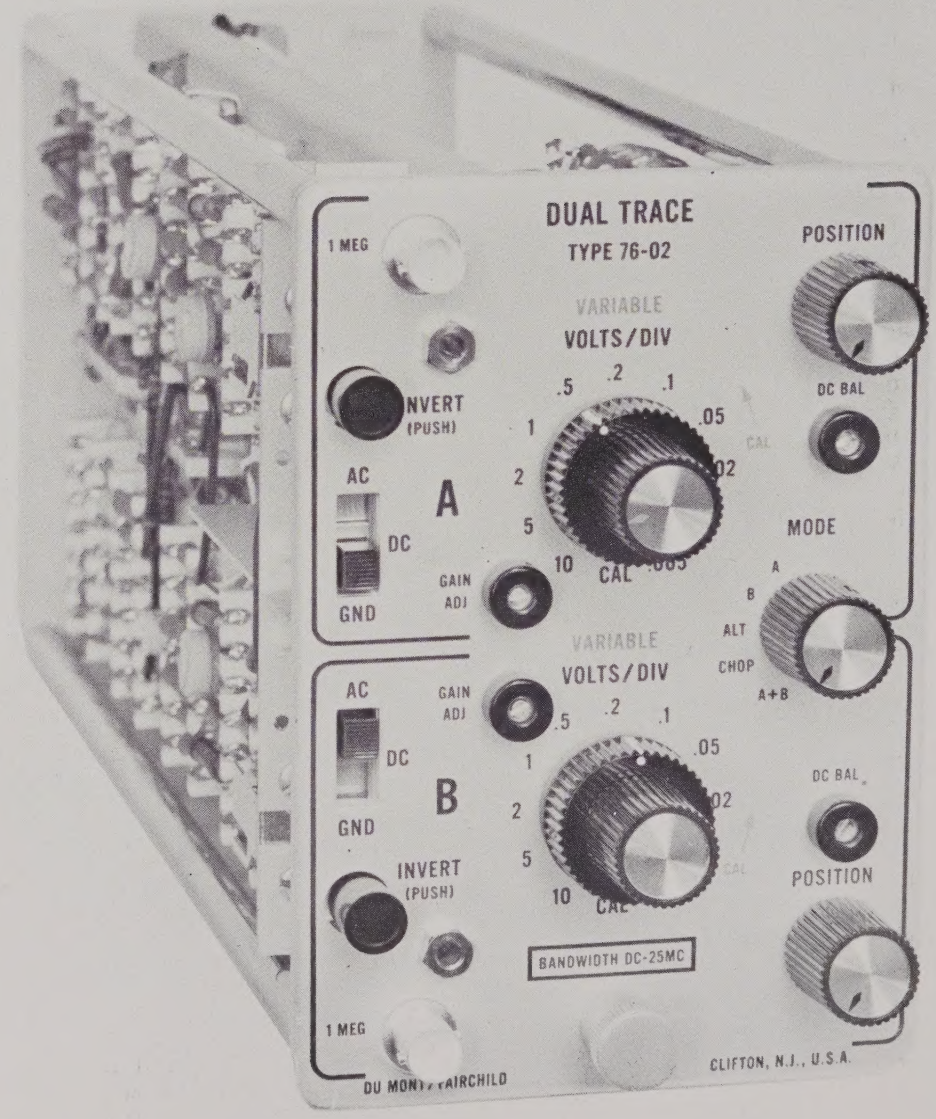


FIGURE 1-1. DU MONT TYPE 76-02 OR 76-02 (D) DUAL TRACE, WIDE BAND, HIGH GAIN PLUG-IN

SECTION 1
OPERATING INSTRUCTIONS

1-1. INTRODUCTION

The Du Mont Type 76-02 Amplifier is a dual-channel amplifier with a bandwidth of 25 megacycles and a sensitivity of 5 millivolts/division. It enables the user to obtain two vertical signals on the screen simultaneously to display either channel individually.

A 230-nanosecond delay is available as an option and this Plug-in Unit is designated as the Type 76-02 (D). References throughout this manual to the Type 76-02 Amplifier pertain also to the Type 76-02 (D) except for the delay line.

The sensitivity of the Type 76-02 Plug-in is variable from 5 millivolts/division to 10 volts/division in 11 steps of 1, 2, and 5 sequence. Accuracy is within ±3% at each of the calibrated steps. The 5 and 10 volts/division attenuator steps are limited to lower frequency operation. All frequency measurements are made at 4-centimeter scan.

The VARIABLE gain control, located concentrically with the VOLTS/DIV switch, has a range of greater than 1 : 2½. This VARIABLE gain control provides continuous overlap between steps of the attenuator (VOLTS/DIV) switch. A detented stop position is provided when the VARIABLE gain control is set to CAL.

A MODE switch is provided which enables the selection of either channel A or channel B for separate display or the combination of both channels for dual display. In addition, ALTERNATE or CHOPPED modes of operation are available. Use of the polarity inversion switch may give A minus B or B minus A presentation.

A front-panel screwdriver GAIN ADJ control is provided on each channel to normalize gain between channels and between the Plug-in and the Main Frame.

The Type 76-02 Amplifier is primarily intended for use in the Y cavity of the Type 765 Series Oscilloscopes.

1-2. TECHNICAL SUMMARY

Electrical and physical characteristics of the Du Mont Type 76-02 or 76-02 (D) Dual Trace Wide Band High Gain Plug-in are listed in Table 1-1 which follows:

TABLE 1-1
TECHNICAL SUMMARY
DU MONT TYPE 76-02 OR 76-02 (D) DUAL TRACE PLUG-IN

BANDWIDTH	
Direct Coupled	DC to 25 megacycles, down 3 db (±2 db) at 25 megacycles (referenced to 50 Kc measured at 4 cm p-p)
Capacitively Coupled	Down 3 db at 10 cycles
Rise Time	15.5 nanoseconds
SENSITIVITY	
Calibrated Operation	Provided by a frequency-compensated attenuator with steps from 5 millivolts/division to 10 volts/division in 11 steps of 1, 2, and 5 sequence when VARIABLE Gain control is set to CAL; accurate to within 3% when set on any one step
Uncalibrated Operation	Continuously variable from 5 millivolts/division to 25 volts/division. The VARIABLE Gain control permits 2½ to 1 continuous sensitivity adjustments between the VOLTS/DIV steps and extends the 10 volts/division range to 25 volts/division. 2 and 5 volts/division ranges limited to lower frequencies.

TABLE 1-1. TECHNICAL SUMMARY (Continued)

INPUT DATA

Input Coupling ..... Each channel is provided with a 3-position slide switch which provides for AC or DC coupling; OFF position also provided

Input Impedance ..... 1 megohm, 42 pf

CALIBRATION

The attenuator includes a CAL position which applies the line-frequency square wave signal directly to the input amplifier. Calibration is accomplished with 4 centimeters of vertical deflection (20 mv peak-to-peak)

POLARITY INVERSION

Each channel is provided with an INVERT push-push switch

DUAL-TRACE MODE

A five-position switch is provided which enables the selection of the following displays:

(1) Channel A only

(2) Channel B only

(3) Channels A and B switched alternately

(4) Channels A and B in chopped operation. Chopping rate is greater than 100 Kc so that each channel is on approximately 5 microseconds and off for 5 microseconds, including the blanking time. Switching transients are automatically blanked

(5) Channel A plus Channel B. Use of polarity inversion switch may give A minus B or B minus A presentation

SIGNAL DELAY

Type 76-02 with Type 7001 Delay Line ..... A 230-nanosecond balanced distributed bifilar helical delay line is available as an accessory. This delay is sufficient to view baseline and the leading edge of the signal triggering the time base

NOTE: For the Type 76-02, the delay line is omitted and a jumper cable is substituted.

INTERNAL TRIGGER

An internal trigger take-off amplifier precedes the delay line. The internal trigger output signal is referenced to ground when the trace is positioned to screen center via factory adjustment of the TRIG DC LEVEL control

ENVIRONMENTAL SPECIFICATIONS

Identical to the Main Frame

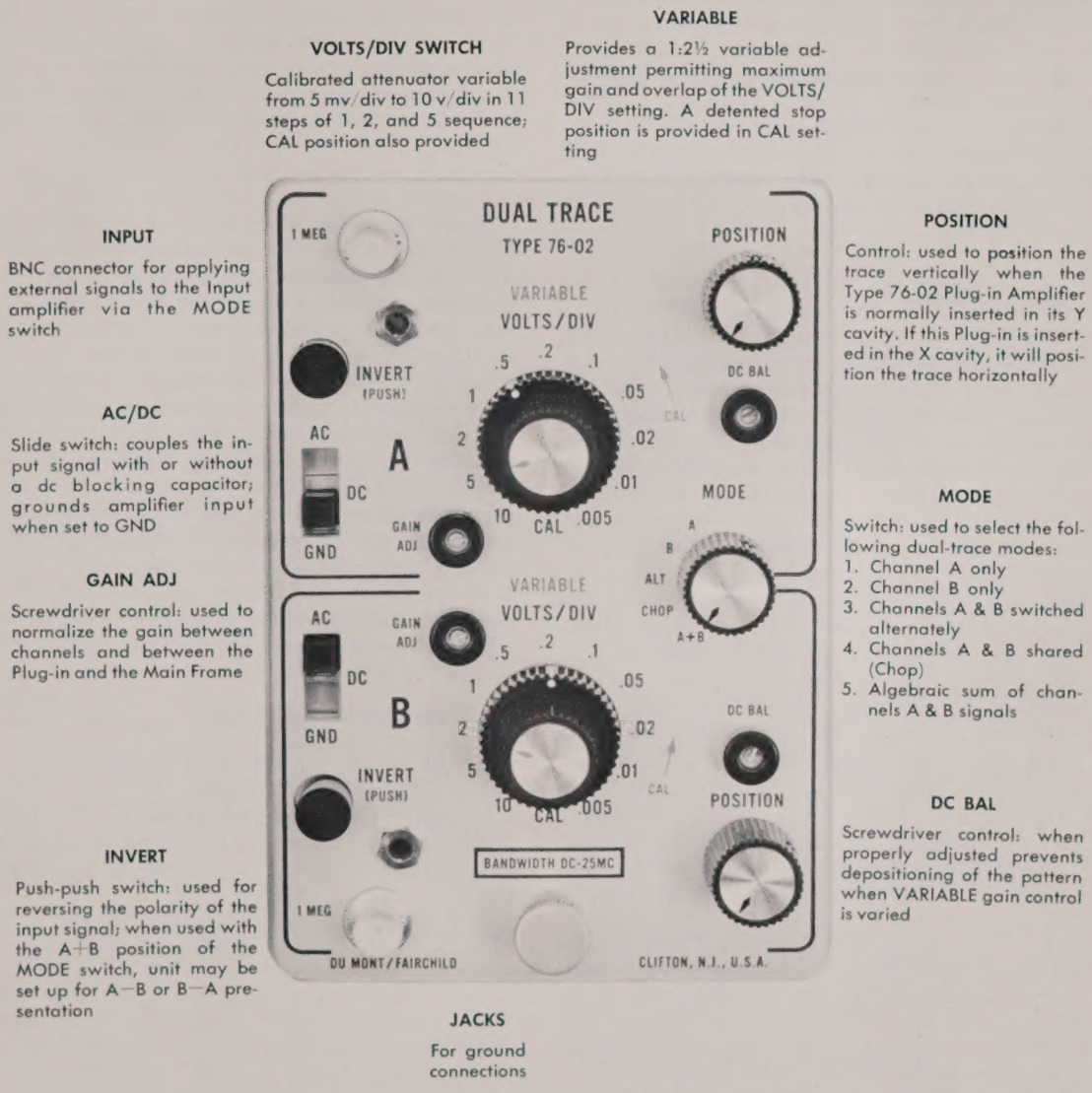
1-3. FIRST-TIME OPERATION (Figure 1-2)

Unless otherwise designated, it is presumed that the Du Mont Type 76-02 Plug-in Amplifier is inserted in the Y cavity (left-hand side) and a Time Base Plug-in unit is inserted in the X cavity (right-hand side) of the Main Frame. If the Type 76-02 Plug-in unit is inserted in the X cavity of the Main Frame, it will provide horizontal deflection of the trace and the information must be translated accordingly. In the instructions which follow, capital letters within the text indicate front-panel controls, connectors, or settings. Refer to Figure 1-2 for a brief description of the front-panel controls and connectors.

1-4. APPLYING A SIGNAL

The signal (or signals) to be displayed is applied to either (or both) input connector on the front panel. To insure proper performance, the signal should be applied through a shielded cable, with the shield connected to the chassis of both the oscilloscope and the signal source.

The Du Mont Accessory Probes are available for


VARIABLE
VOLTS/DIV SWITCH
Calibrated attenuator variable from 5 mv/div to 10 v/div in 11 steps of 1, 2, and 5 sequence; CAL position also provided
Provides a 1:2½ variable adjustment permitting maximum gain and overlap of the VOLTS/DIV setting. A detented stop position is provided in CAL setting
INPUT
BNC connector for applying external signals to the Input amplifier via the MODE switch
AC/DC
Slide switch: couples the input signal with or without a dc blocking capacitor; grounds amplifier input when set to GND
GAIN ADJ
Screwdriver control: used to normalize the gain between channels and between the Plug-in and the Main Frame
INVERT
Push-push switch: used for reversing the polarity of the input signal; when used with the A+B position of the MODE switch, unit may be set up for A−B or B−A presentation
DUAL TRACE
TYPE 76-02
1 MEG
INVERT
(PUSH)
AC
DC
GND
A
GAIN ADJ
VARIABLE
VOLTS/DIV
.5
.2
.1
1
.05
2
.02
5
.01
10
CAL
.005
CAL
POSITION
DC BAL
MODE
A
B
ALT
CHOP
A+B
B
BANDWIDTH DC-25MC
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POSITION
Control: used to position the trace vertically when the Type 76-02 Plug-in Amplifier is normally inserted in its Y cavity. If this Plug-in is inserted in the X cavity, it will position the trace horizontally
MODE
Switch: used to select the following dual-trace modes:
1. Channel A only
2. Channel B only
3. Channels A & B switched alternately
4. Channels A & B shared (Chop)
5. Algebraic sum of channels A & B signals
DC BAL
Screwdriver control: when properly adjusted prevents depositioning of the pattern when VARIABLE gain control is varied
JACKS
For ground connections

FIGURE 1-2. FUNCTION OF CONTROLS AND CONNECTORS

use with the Type 76-02 Amplifier and are listed in the Main Frame manual.

1-5. DUAL TRACE OPERATION

Using the Type 76-02 Dual Trace Plug-in unit with the Main Frame, makes it possible to view two different time-shared vertical input signals displayed against one time base. The electronic switch will alternately accept either the Channel A or Channel B signal when the MODE switch is set to ALT. Each channel retains individual control of sensitivity, position, polarity, etc. Should the sweep rate be so low that the display has excessive flicker, the MODE switch may be set to CHOP position. The electronic

switch will now chop the signals at approximately 100 Kc rate. Switching transients will automatically be blanked for a clean, undistorted display.

The dual-trace display applications include comparisons of the input and output of the amplifiers, multivibrators, shaping circuits, comparative phase and time delay measurements, etc.

Do not use internal triggering when in the chopped mode, since the random switching transients will cause poor synchronization of the sweep.

1-6. USE OF PROBES

An attenuator probe lessens both the capacitive and resistive loading caused by the oscilloscope to a minimum value. Simultaneously, while isolating the oscilloscope from the signal source, it reduces the effective sensitivity of the instrument. In other words, the displayed waveform will be reduced in amplitude by the attenuation factor of the probe. The attenuation introduced by the probe permits measurement of signal voltages in excess of those which may be accommodated by the instrument.

When using a probe to sample signals from a tuned, matched, or otherwise critical circuit, capacitive loading may cause erroneous readings. In these cases it may be necessary to add capacity and resistance to the circuit under intended observation of a value precisely equal to that of the probe impedance after the probe is removed from the circuit. This substitution will equalize loading and restore the measured characteristics of the circuit under observation.

When using the attenuator probe to make amplitude measurements, multiply the observed amplitude of the display by the attenuation factor marked on the probe.

The Du Mont Type 4290 Accessory Probe has an attenuation factor of 10 to 1. The maximum voltage that may be applied to the probe is 1200 volts peak-to-peak, 600 volts dc. Voltages in excess of this value (either dc volts or peak ac volts) may cause damage to components inside of the probe housing.

IMPORTANT: Before using the probe, always check its adjustment.

An adjustable capacitor in the probe compensates for variations in input capacitances from one unit to another. To insure accuracy in pulse and transient measurements, check the probe adjustment frequently. To check the probe, proceed as follows:

1. Connect the Probe to input BNC connector on the Type 76-02 and apply the probe tip to the 1V CAL pin jack on the Main Frame.

2. Adjust the oscilloscope to display several cycles of the calibrator waveform.

3. Adjust the variable capacitor in the body of the probe for a flat-top trace on the screen.

To preserve the waveform of the signal being displayed, clip the probe ground lead to the chassis of the equipment being tested. Select a short clean ground point near the probe input connection.

1-7. INPUT COUPLING SELECTION

The AC/DC switch permits choice of retaining the dc level of the input signal or blocking the dc component of the input signal by inserting a capacitor in series with the input. If it is desired to display both the ac and dc components of a signal, set the AC/DC switch to DC. Thus, the position of the display at any instant is a function of the instantaneous signal voltage with respect to ground.

There are times when it is neither necessary nor desirable to display the dc component of the input waveform. A capacitor placed in series with the input connector will exclude the dc component while simultaneously permitting the ac component to be displayed. This is accomplished when the AC/DC switch is set to AC. In this instance, the effect of the dc component is excluded from the display. It should be noted that when the AC/DC switch is set to the AC position, the lower frequency limit (3 db) of the amplifier is about 10 cycles. Therefore, some low-frequency distortion and loss of amplitude will occur if the pattern on display contains frequency components below the specified cutoff.

When the AC/DC switch is set to GND, the input circuit of the Type 76-02 is grounded, but the applied signal is not grounded.

1-8. OBTAINING A DISPLAY

To use the Du Mont Type 76-02 Amplifier to obtain a display, proceed as follows:

1. Signals to be observed are connected to the Type 76-02 Amplifier through the Channel A and/or Channel B connector via shielded cable or an Attenuator Probe.

2. Establish a common ground between the oscilloscope chassis and the signal source.

3. If it is desired to display a single trace with the Type 76-02 Amplifier, simply apply the signal to either Input connector and set the MODE switch to the corresponding position (A or B).

4. To display two signals simultaneously, connect a signal to each Input connector and set the MODE switch to ALT or CHOP. The chopped position is used when it is desired to reduce the "flickering" of the display when observing input signal data at slow sweep speeds (below 1 millisecond/cm). External triggering of the Time Base is to be preferred in chopped position to prevent the sweep from triggering on the "chopping" signal.

In general, the CHOP position is used with lower sweep rates and the ALT position with higher sweep rates.

5. To display the algebraic sum of two signals, connect a signal to each Input connector and set the MODE switch to A+B.

6. To display the algebraic difference of two signals, proceed as in step 5 and push either channel A INVERT switch or channel B INVERT switch. Thus,

use of the polarity inversion switch may give A minus B or B minus A presentation.

7. Adjust the appropriate Time Base Plug-in controls to obtain a stable display of the pattern.

8. Set the VOLTS/DIV switch and POSITION control such that the size and position of the display is as desired on the screen.

1-9. ADDITIONAL HINTS

In addition to the information given in the paragraphs preceding, observe the following precautions when applying signals to the oscilloscope:

1. Avoid errors in readings due to stray coupling between circuits, particularly in the signal lead. As a rule, do not use long unshielded leads for applying signals to the oscilloscope. This fact holds for the audio-frequency spectrum, except possibly when making measurements on low impedance circuits at very low frequencies. When shielded leads are used, the shields should be grounded to the oscilloscope ground terminal and to the chassis of the equipment being tested. Coaxial or shielded input cables are recommended for most applications.

2. In broadband applications, it may be necessary to terminate a coaxial cable with a resistance equal to its characteristic impedance. This is done to prevent standing waves or ringing (high-frequency damped oscillations).

3. As the length of the cable is increased, the necessity for proper termination becomes very important. This termination is generally inserted at the oscilloscope end of the cable, although many signal sources may require an additional termination at the other end of the cable.

4. To avoid erroneous results, the operator should simulate the actual operating conditions of the equipment being tested. For example, the equipment should work into a load impedance equal to that which it will see in actual use.

5. Consider the effect of loading upon the signal source due to the input impedance of the oscilloscope. The input impedance can be represented by a resistance shunted by a capacitance. The effective value of this impedance is indicated in Table 1-1 of this manual. However, the operator should be aware that even with a few feet of cable in the input circuit, the loading capacitance on the circuit under investigation might be greater than 100 pf ($\mu\mu$f).

6. There are cases when connecting the input of the oscilloscope to a signal source, the effect of loading the source is not negligible. To minimize this loading and therefore obtain a valid measurement, a probe may be used in the manner described in the paragraph entitled "Use of Probes." The Du Mont Type 4290 Attenuator Probe is recommended for general purpose use.

7. Care must be exercised when applying a fast rise, high-frequency signal to the input connector. It will be necessary to match and properly terminate the coaxial cable applying the signal to the oscilloscope.

8. The 5 and 10 volts/division ranges have limited response and should not be used for signals rising faster than 35 nanoseconds.

1-10. DC BAL ADJUSTMENT

If the dc balance of the Type 76-02 Amplifier is not properly adjusted, the reference trace on the screen will be depositioned when the VARIABLE control is rotated. To properly adjust the DC BAL front-panel screwdriver control, proceed as follows:

1. Set VOLTS/DIV switch to 10 and rotate VARIABLE control fully counterclockwise.

2. Adjust the appropriate Time Base Plug-in controls to obtain a reference trace on the screen.

3. Using the POSITION control on the Type 76-02 Amplifier, position the trace to screen center.

4. Adjust the DC BAL control to the point where there is no depositioning of the trace when the VARIABLE control is rotated back and forth throughout its range.

1-11. GAIN ADJUSTMENT

Whenever the Type 76-02 Amplifier is removed from the Main Frame and inserted in another, the front-panel screwdriver GAIN ADJ control must be reset. This procedure is necessary to compensate for difference in deflection plate sensitivities. In addition, if the Type 76-02 Amplifier is switched from the Y cavity to the X cavity of the same Main Frame, readjustment will be necessary since the difference in average deflection plate voltages between modules affects the over-all deflection sensitivity of the cathode-ray tube. To properly normalize the gain between channels or between the Plug-in Unit and the Main Frame, proceed as follows:

1. Set the VOLTS/DIV switch to CAL and turn the VARIABLE control to CAL.

2. Set the front-panel screwdriver GAIN ADJ control for precisely 4 divisions (cm) of deflection.

1-12. VOLTAGE MEASUREMENTS

NOTE

When making voltage measurements, make sure there is a common ground between the oscilloscope and the signal source.

a. General

The Du Mont Type 765 Family of Oscilloscopes may be used to measure the voltage of the input signal by using the calibrated VOLTS/DIV setting and observing the height of the display on the screen in graticule divisions.

When making voltage measurements, the operator should try to set up the instrument for full scale vertical deflection to insure maximum accuracy. Also,

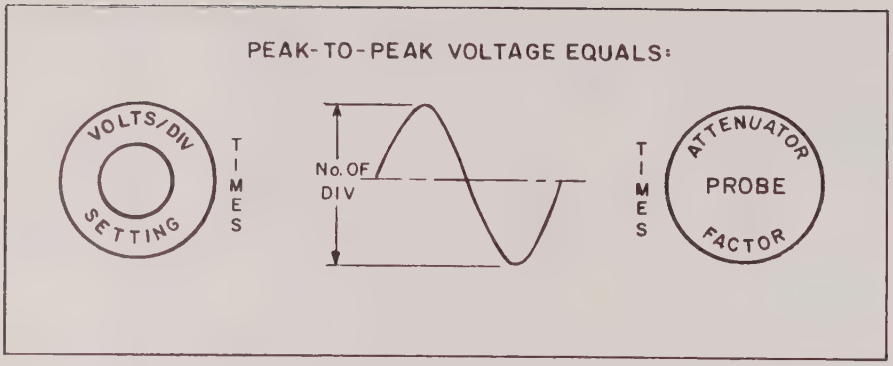


FIGURE 1-3. PEAK-TO-PEAK VOLTAGE MEASUREMENTS

it is important to remember that the width of the trace may be an appreciable part of the over-all measurement. This is particularly true when you are measuring signals of small amplitude or when stray signal pickup has broadened the trace. The operator should consistently make all measurements from one side of the trace. If the top side of the trace is used for one reading, it should be used for all succeeding readings.

b. How to Measure Peak-to-Peak Voltages Using the CRT Scale

The procedure employed for all voltage measurements is basically the same. The VARIABLE control must be set to CAL. The specific examples that follow are intended to show the general procedure. These examples may be adapted to fit any particular application.

To measure the ac component of the signal on display, set the AC/DC switch to AC. In this position, only the ac components of the input signal are displayed on the screen. However, when the ac component of the input is of very low frequency (under 10 cps), set the AC/DC switch to DC to prevent errors

To make measurements, proceed as follows:

1. Using the calibrated scale, measure the vertical deflection in graticule divisions from the positive peak to the negative peak of the waveform. See Figure 1-3.

2. Multiply the vertical dimension obtained in Step 1 by the VOLTS/DIV switch setting to obtain the indicated voltage.

3. Multiply the indicated voltage obtained in Step 2 by the attenuation factor of the probe, if one is used, to obtain the actual peak-to-peak voltage.

For example, suppose that you are using a 10:1 Attenuator Probe and the VOLTS/DIV switch is set to 0.1. Assume that the vertical distance between the peaks of the waveform measures 4 graticule divisions. Now, this graticule dimension of 4 is multiplied by the VOLTS/DIV setting of 0.1 to give 0.4. Next, multiply this result by 10, if one is used, the attenuation ratio of the probe. This gives 4 volts as the peak-to-peak voltage of the display waveform.

NOTE: Always make sure that the VARIABLE control is set to CAL when making measurements.

c. How to Measure Instantaneous Voltages with Respect to Ground (or some other Reference Potential) Using the CRT Scale

The technique used for measuring instantaneous voltages with respect to a reference point, is virtually the same as that described for peak-to-peak voltage measurements. The difference is that now a reference point must be established on the screen of the oscilloscope. Since voltage measurements with respect to ground are the most common, the procedure which follows, establishes ground as the reference point. The same general technique may be used for instantaneous measurements with respect to any other potential, just so long as that potential is employed to establish the reference point.

To make measurements, proceed as follows:

1. Set the AC/DC, switch to DC.

2. Adjust the appropriate Time Base Plug-in controls to obtain a reference trace.

3. To establish the reference point, touch the probe tip to the ground terminal on the oscilloscope (or to the desired source potential, if a point other than ground is used). Vertically position the trace to a convenient point on the screen. This point should be chosen so that it lies on one of the major horizontal scale divisions. The chosen horizontal scale line, which is now coincident with the trace, is the reference line from which all voltage measurements are to be made.

4. Disconnect the probe tip from ground and connect it to the signal source without disturbing the POSITION control.

5. Adjust the oscilloscope controls for a suitable and stable display.

6. Using the calibrated scale, measure the number of graticule divisions from the desired point on the waveform to the pre-established reference line set up in Step 3. See Figure 1-4.

7. Multiply the graticule dimension obtained in Step 6 by the VOLTS/DIV switch setting to obtain the indicated voltage. Make sure that the VARIABLE control is set to CAL.

8. Multiply the indicated voltage obtained in Step 7 by the attenuation factor of the probe used to obtain the actual instantaneous voltage.

For example, suppose that you are using a 10:1

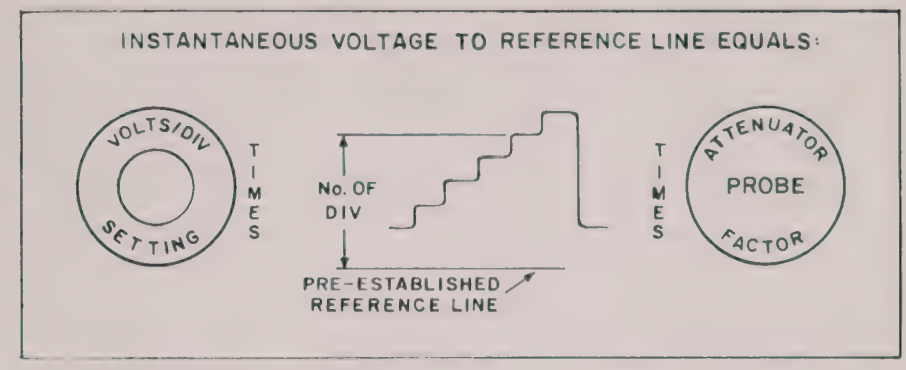


FIGURE 1-4. INSTANTANEOUS VOLTAGE MEASUREMENT WITH RESPECT TO GROUND (OR SOME OTHER REFERENCE POTENTIAL)

Attenuator Probe and the VOLTS/DIV switch is set to 0.1. Assume that the vertical distance between the desired point on the waveform to the pre-established reference line is 4 graticule divisions. Now, multiply this vertical deflection of 4 divisions by the VOLTS/DIV setting of 0.1 to give 0.4 volt. Next, multiply this result by 10, the attenuation factor of the probe. This shows the instantaneous voltage with respect to ground to be 4 volts. Since the voltage point is above the reference line, the indicated polarity is positive.

1-13. DUAL-TRACE TRIGGERING

For dual-trace operation, it is preferable to trigger the time base with an external signal which bears a fixed time relationship to the applied signal. One of the applied signals may normally be employed as the external triggering signal. When this technique is used, a stable display is more readily obtained, and the true time or phase relationship of the two signals is discernible.

Internal triggering of the time base may be used if the time or phase relationship between the two signals is not critical. Also, when using internal triggering in the ALT mode, set the TRIGGER COUPLING switch to ACF. Refer to the Time Base Plug-in Instruction Manual for further information on triggering.

1-14. DUAL X-Y DISPLAYS

It is possible to display two different sets of X-Y parameters on the Du Mont Type 765 Family of Oscilloscopes through the use of two Type 76-02 Plug-in Amplifiers. This technique is useful if it is desired to observe operating characteristics of two identical items, such as electron tubes, under different operating conditions. To display two sets of X-Y parameters simultaneously, proceed as follows:

1. Insert a Type 76-02 Plug-in into each cavity of the Type 765 Series Oscilloscopes.

2. Set the MODE switch of one plug-in unit to CHOP and the other one to ALT.

3. Apply one pair of signals to the Channel A Input connectors and the other pair of signals to the Channel B connectors.

4. Set the VOLTS/DIV switches and the POSITION controls for the desired display.

SECTION 2
MAINTENANCE AND RECALIBRATION

2-1. INTRODUCTION

This section of the Instruction Manual contains the circuit description, trouble-shooting instructions, and calibrating procedures for the Du Mont Type 76-02 Dual Trace Amplifier.

The Type 76-02 Plug-in is a two-channel amplifier designed for use with the Type 765 Series Oscilloscopes. It consists of two identical input channels (Channel A and Channel B), an electronic switching system, and a common vertical deflection amplifier. The output of either or both input channels may be applied to the common vertical amplifier depending on the condition of the electronic switch as follows:

1. Channel A only.
2. Channel B only.
3. Channels A and B switched alternately.
4. Channels A and B in chopped operation.
5. Channels A and B in a differential display.

In the discussion to follow, emphasis is placed on the interrelation of circuits rather than on detail of operation. It is also recommended that the schematics at the rear of the manual be referred to in following the circuit description.

2-2. INPUT AMPLIFIER CIRCUIT DESCRIPTION (Figure 2-1)

a. Input Channel

Each input channel consists of an attenuator, and a pre-amplifier. Since the input channels are identical, the circuit description will refer to Channel A only.

Operation of Channel B will be the same as A except where otherwise noted.

The desired signal to be displayed is applied to the INPUT A connector and fed to the grid of the common cathode amplifier, V920 and V921, through the AC/DC and attenuator switches. The ac coupling capacitor, C9115, provides for a low-frequency cut-off of 10 cycles and is switched in when the dc reference level of the input waveform is not of interest.

The VOLTS/DIV switch, S910, consists of compensated RC attenuators permitting the desired attenua-

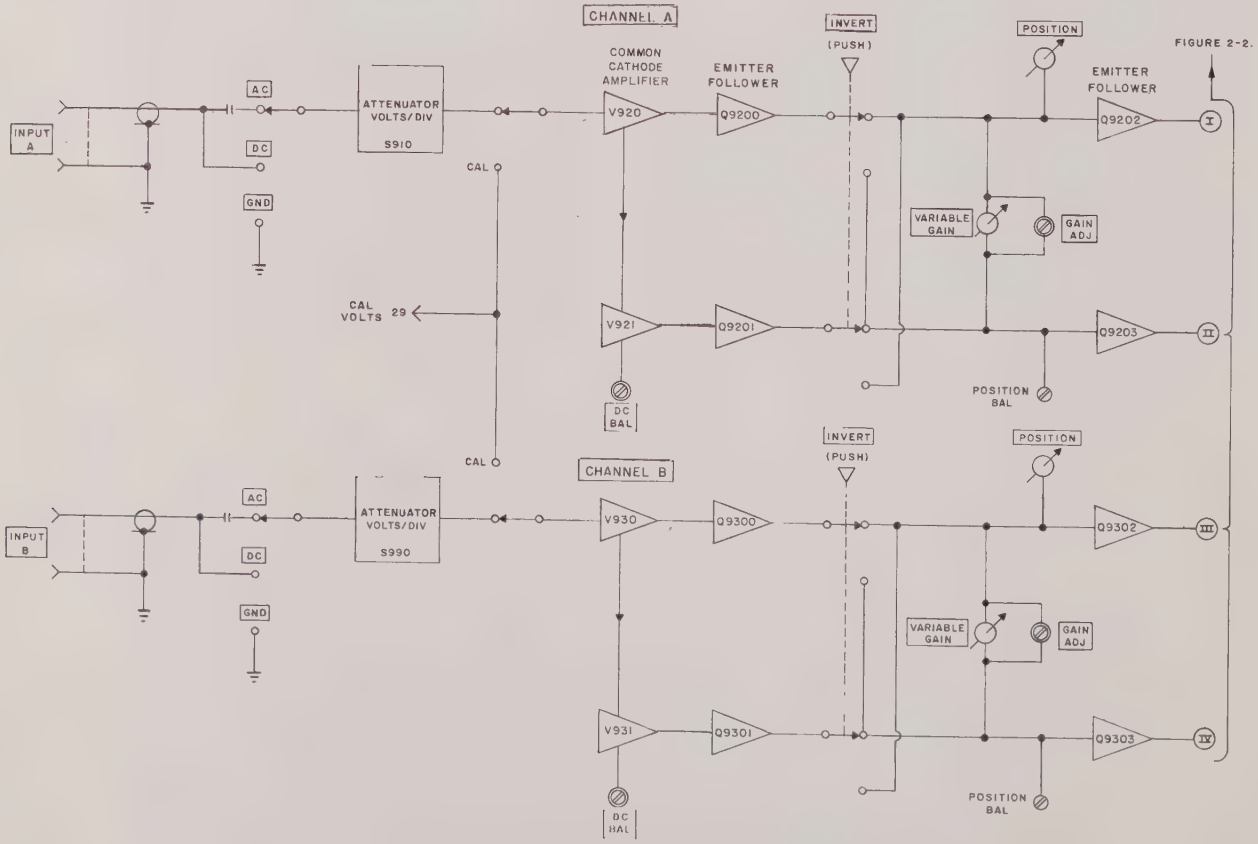


FIGURE 2-1. DUAL TRACE, INPUT AMPLIFIER FUNCTIONAL BLOCK DIAGRAM

tion of the input signal in 11 steps from 5 millivolts to 10 volts per division. In the CAL position, the calibrator signal is applied to the input of the common cathode amplifier, V920 & V921, and may be used to facilitate calibration check. When gains are normalized, the peak-to-peak value of the calibrator waveform will indicate 4 centimeters of vertical deflection on the screen. The design of the attenuator provides a constant input impedance of 1 megohm and 42 picofarads at all settings of the VOLTS/DIV switch.

b. Pre-Amplifier

The nuvistor common cathode amplifier, V920 & V921, converts the single-ended input signal at the grid of V920 to a push-pull output signal at the plates of V920 & V921.

Resistors R9207 and R9209 in series with the grids of these tubes, serve to suppress any parasitic high-frequency oscillations. Resistor R9206 is inserted to limit grid current in the event that any excess voltage is applied to the input. A DC BAL control nulls the dc voltage across the VARIABLE GAIN control, so that in the absence of an input signal, there will be no depositioning of the trace when the VARIABLE control is rotated throughout its range.

The push-pull output signal from the common cathode amplifier, progresses through the amplifier stages as indicated on the functional block diagram, Figure 2-1. Ferrite beads are used in the plate leads of the common cathode amplifier and in the collector lead of the two succeeding emitter follower stages to suppress parasitic oscillations. (Reference symbol, HY, is used on the schematics to denote these beads as hybrid coils.)

The Channel A INVERT push-push switch, S920, makes it possible to invert the displayed waveform with respect to the signal applied to the INPUT A connector. Thus, when the MODE switch is set to A+B, (and a signal is also applied to Channel B), it is possible to obtain A minus B or B minus A presentation.

The GAIN ADJ control in the emitter circuit of Q9200 and Q9201 is used to set the deflection factor equal to that indicated by the VOLTS/DIV switch when the VARIABLE GAIN control is set to CAL. In the uncalibrated position, the VARIABLE GAIN control permits 2½ to 1 continuous sensitivity adjustments between the VOLTS/DIV steps.

The POS BAL adjustment, R9234R, is provided so that the Y POSITION control may be set to its electrical vertical center when the trace is vertically centered on the screen.

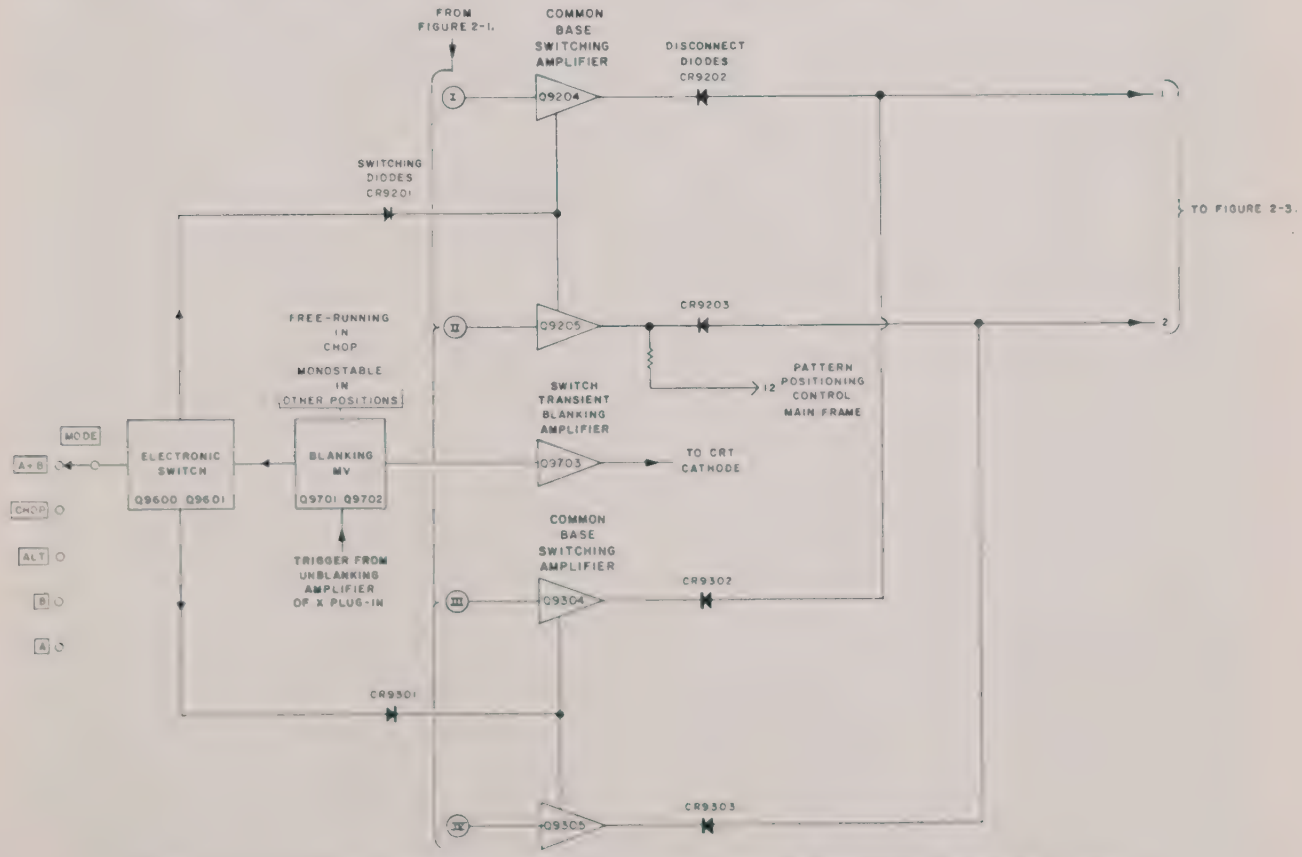


FIGURE 2-2. DUAL TRACE, ELECTRONIC SWITCHING CIRCUIT FUNCTIONAL BLOCK DIAGRAM

2-3. ELECTRONIC SWITCH CIRCUIT DESCRIPTION (Figure 2-2)

a. Blanking Multivibrator

Selection of the input channel whose output is to be applied to the common vertical deflection amplifier is accomplished by means of the Electronic Switching circuit.

The timing of the electronic switch, Q9600 and Q9601, is provided by the blanking multivibrator Q9701 and Q9702. The blanking mutivibrator may be switched to either a monostable or a free-running condition by the MODE switch, S960. When the MODE switch is set to A, B, A + B, or ALT, a negative bias is applied through resistor R9705 and diode CR9708 to the base of transistor Q9702. This action locks the blanking multivibrator in the monostable state with Q9702 turned off and Q9701 turned on.

When the MODE switch is set to CHOP, this bias voltage is removed, permitting free-running operation of this stage at a repetition rate greater than 100 Kc. This gating voltage is applied to the electronic switch which alternately functions to turn Channels A and B off and on at a 100-Kc rate, independent of the sweep rate. Each channel is *on* approximately 5 microseconds, and *off* for 5 microseconds including the blanking time.

External triggering of the Time Base is to be preferred in the chopped position to prevent triggering of the sweep on the *chopping* signal.

The timing of the blanking multivibrator is determined by the master trigger from the unblanking amplifier of the Time Base Unit. This positive-going master trigger is coincident with the trailing edge of the sweep gate and is applied through the series coupling diode CR9704 to the base of Q9702, turning it on momentarily. Consequently, one narrow negative pulse is generated at the collector of Q9702 for each positive trigger input. However, in the free-running position only, the ouput of the blanking multivibrator is independent of the input triggering signal.

It is necessary to turn off the cathode-ray tube beam as the switching between channels occurs. This is accomplished by applying the negative pulse generated at the collector of Q9702 to the switch-transient blanking amplifier Q9703. The resulting +35-volt blanking pulse is applied to pin 4 of the interconnecting plug to the cathode of the CRT.

b. Electronic Switch

When the MODE switch is set to A + B, the B+ voltage for the electronic switch, Q9600 and Q9601, is disconnected. This allows both pre-amplifier channels to work simultaneously, thus providing a computer type algebraic adder circuit (no common mode rejection) for Channels A & B. Use of the INVERT switch (polarity inversion) may give A minus B or B minus A presentation.

Due to loading of one channel by the other, the bandwidth of the system is reduced by a factor of 2 in this position.

In positions A or B of the MODE switch, a cut-off bias is applied to the appropriate side of the electronic switch, holding the inactive channel in a continual cut-off position. In other words, the electronic switch is locked, (Q9600 is continually on, and Q9601 is continually off, or vice versa) and will not respond to the triggering signals from the blanking multivibrator.

For example, when the MODE switch is set to B, a fixed bias is applied through R9605 to the base of Q9600, cutting it off; at the same time, Q9601 is fully conducting. The elevated voltage at the collector of Q9600 is applied to the collector of switching diode CR9201, thus causing it to conduct. The emitters of Q9204 and Q9205 are raised, thus plunging this stage into cutoff. Hence, Channel A pre-amplifier output is arrested at this point.

The collector of switching diode CR9301 connected to Channel B is back-biased by the depressed voltage from Q9601. This permits the emitters of Q9304 and Q9305 to operate at their normal bias. Thus, only Channel B output progresses to the common vertical deflection amplifier.

When the MODE switch is set to A, just the opposite condition exists. Channel B stage, Q9304 and Q9305, is cutoff and Channel A stage, Q9204 and Q9203, conducts.

Diodes in the collector leads of each of the switching output stages of the pre-amplifier disconnect the collectors when the amplifier is turned off. This technique isolates the active adjacent channel collectors which would otherwise be in parallel with the inactive channel and cause capacitive loading. In this way, the maximum available bandwidth may be maintained.

In the ALT or CHOP positions of the MODE switch, no fixed bias is applied, thus permitting the electronic switch to be keyed at will by the blanking multivibrator. Thus, Q9600 and Q9601 become a bistable switching multivibrator.

When the MODE switch is set to ALT, the cathode-ray tube displays the signal in one channel for one sweep of the beam, and the signal in the other channel for the next sweep of the beam.

2-4. COMMON DEFLECTION AMPLIFIER (Figure 2-3)

The output from the channel switching amplifier is applied to the common emitter followers Q9400 to Q9403.

A Du Mont Type 7001 balanced distributed bifilar helical delay line is available as an accessory. The delay provided is sufficient to view baseline and the leading edge of the signal triggering the time base, when the instrument is set up for internal triggering. Filters Z9401 and Z9402 provide proper termination for the output impedance of the delay line.

Just before the delay line is encountered, a portion of the signal from the common emitter followers, Q9402 and Q9403, is applied to the trigger pick-off

amplifier. This latter circuit, Q9501 to Q9503, provides an internal trigger signal for firing the time base circuit as desired. Ferrite beads are used in the base leads of Q9406 and Q9407 and in subsequent stages suppress parasitic oscillations.

When using the dual-trace feature of this Plug-in for internal triggering of the time base, always use ACF coupling to avoid triggering on the change in dc positioning level between channels. All signals having low-frequency components above 10 Kc should use external trigger coupling.

A network consisting of R9254, R9255, R9256, R9261, C9218, R9443, and R9444, provides a feedback circuit to preserve the input signal waveform as it progresses through the amplifier.

The output from the delay line (if one is used) or from the preceding stage, is applied to a series of amplifiers denoted as the drivers. These drivers are operated in parallel to provide the necessary power requirements for driving the vertical deflection plates of the CRT.

2-5. LOCATION OF REPLACEABLE COMPONENTS (Figures 2-4 and 2-5)

Identifications of all replaceable components, including those mounted on assembly boards are shown in Figures 2-4, 2-5, and 4-1.

Since the production of this instrument, some of the parts may have been superseded by improved components. In such cases, the part numbers of these new components will not be listed in your Parts List. However, if you order a part from Du Mont, and it has been superseded by an improved component, the new part will be shipped in place of the part ordered. Your local Du Mont representative has knowledge of these changes and may call you if a change in your purchase order is necessary.

It is the aim of the Du Mont organization to make available the most reliable commercial oscilloscopes within the state of the art and to provide services which will help the user to rapidly restore any Du Mont equipment to its specified performance. Your local Du Mont field representative maintains a limited number of spare parts, or the factory may be asked to air-ship replacement parts.

2-6. SERVICING HINTS

General maintenance and trouble-shooting information is given in the Type 765 Series Oscilloscope Instruction Manual. In the following discussion, it is assumed that you have already read that information and have definitely isolated a trouble in the Plug-in unit.

In trouble shooting a Plug-in unit, it becomes necessary to determine if the defect is in the plug-in or in the Main Frame of the oscilloscope. The quickest and easiest way of isolating the trouble is to substitute another plug-in unit and determine if the same trouble persists. If the trouble continues after substitution, it can be safely assumed that the defect is in the Main Frame.

There is no simple way of locating troubles. An

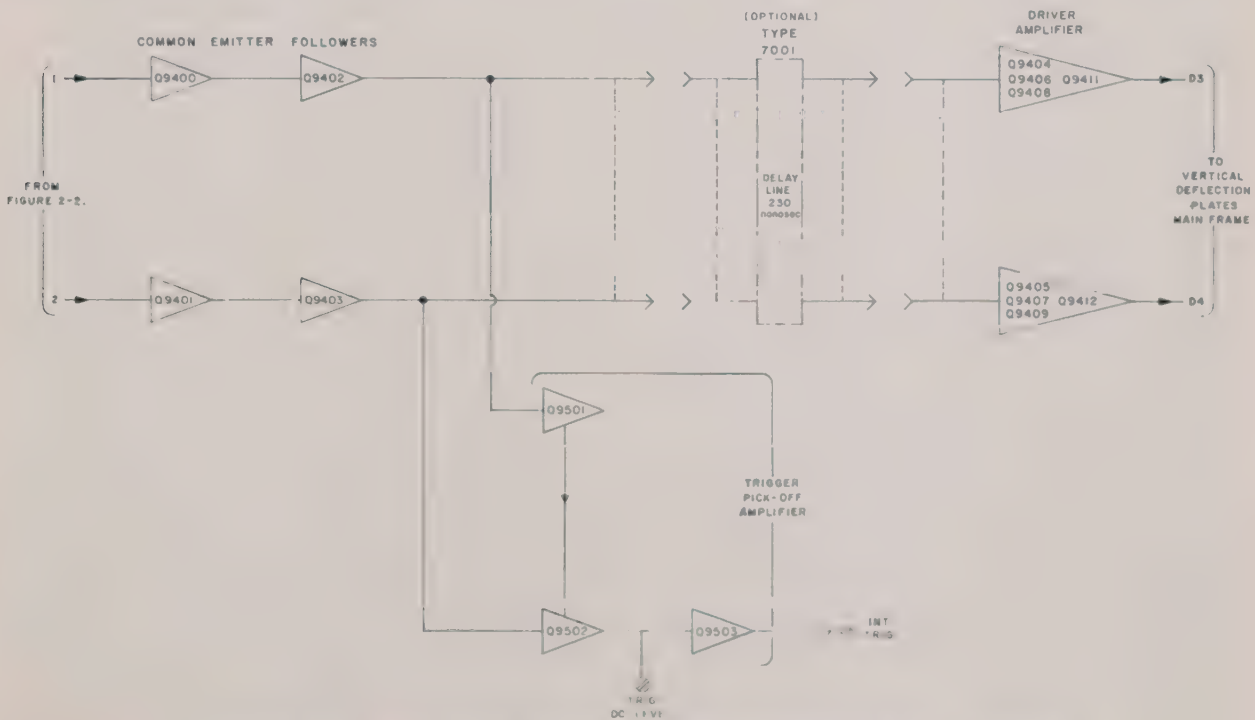


FIGURE 2-3. DUAL TRACE, DRIVER AMPLIFIER FUNCTIONAL BLOCK DIAGRAM

understanding of the functions of the circuits is the best help. With an understanding of the circuit operation, it will be possible to make a good guess at the general source of troubles from the symptoms. As an aid in trouble shooting this unit, refer to the functional block diagrams, Figures 2-1 through 2-3, and to the schematics.

To keep electronic units operating at top performance, it is desirable to check the equipment at regular intervals. The period between checks will depend on the installation and the conditions of operation. In general, portable units moved about constantly, or units operated in very hot, moist, or dirty areas will require more frequent service.

For these regular checks, clean all dust and dirt from the unit using a light air blast or soft brush.

In the event of improper performance of the Plug-in Unit, the following suggestions are recommended:

1. The Du Mont Type 4294 Extension Cable for remote operation of the plug-in from oscilloscope, is available as an accessory. This plug-in extender will be helpful for routine maintenance and recalibration. Its use is mandatory for the Type 767 Rack-mounted Oscilloscope which is not provided with side access to the adjustments.

2. A Du Mont Type 766 Test Oscilloscope is recommended for localizing troubles, especially when servicing a Type 76-02 inserted in a Type 747/767 Oscilloscope. To check waveform, use a high-impedance probe. The Du Mont Type 4290 or Type 4298 Attenuator Probe is recommended for this application.

3. Maintain a high quality of workmanship. Use a clean bench and soldering iron; keep solder joints smooth and bright; do not overheat any component while soldering. Use heat sinks when soldering semiconductors. The use of a 30-watt iron such as a Hexacon Type 26S is recommended. When using accessory probes or adapters, be sure the trouble is not originating in the accessory before suspecting the oscilloscope itself.

WARNING

WHEN THE PANELS OR PLUG-INS ARE REMOVED FROM THE INSTRUMENT FOR SERVICING, EXERCISE CAUTION WHILE THE POWER IS ON.

The lower-voltage busses are potentially more dangerous than the cathode-ray tube potential because of the high-current capabilities and large filter capacitors employed in these supplies. When you reach into the instrument with one hand while it is turned on, do not grasp the metal frame with the other hand. If possible, stand on an insulated floor and use insulated tools. It is advisable to ground the third lead in the power cord whenever the instrument is in use.

2-7. GAINING ACCESS TO CHASSIS

Since the Plug-in is not contained in its own dust cover, most of the components are readily accessible when the Plug-in is removed from the Main Frame. To gain access to the chassis, simply unscrew the knurled thumbscrew at center bottom of unit and pull it free of the Main Frame.

2-8. TEST EQUIPMENT REQUIRED FOR SERVICE ADJUSTMENTS

a. Introduction

The adjustments outlined in the following paragraphs are based on the test procedure followed at the factory. All adjustments should be made at mid-line voltage, 115V/230V $\pm 2\%$.

To set up the Amplifier Plug-in Unit for calibration, insert the Amplifier Plug-in and the Time Base Plug-in into the Main Frame. The Time Base Plug-in module and the Main Frame must be fully tested and certified units.

b. Test Equipment Required (Equivalent may be substituted)

Type	Description
Square Wave Generator	Tektronix Type 105A and 93-ohm Cable Termination Type B93R
Square Wave Generator	Tektronix Type 107 and 93-ohm Cable Termination Type B93R
Volt-ohmmeter	Simpson Model 260, 20,000 ohms/volt
Alignment Tool	Insulated screwdriver
Termination, 50-ohm	Du Mont Type 4285 with RG8A/U 50-ohm cable
Capacitance Checker	Kay Lab Model 407B Micro-Miker; and 42-picofarad capacitance standardizer
Extension Cable for Remote Operation of Plug-in	Du Mont Type 4294

Turn on the power and allow 5 minutes of warmup time. In the meantime, preset front-panel controls as indicated:

Control	Type
TRIG LEVEL	PRESET (Pushed in)
SWEEP MODE	TRIG
TRIGGER SOURCE	EXT
TRIGGER COUPLING	AC
TRIGGER SLOPE	OFF
SWEEP RATE	5 mSEC
VARIABLE SWEEP RATE	CAL (Fully cw and pushed in)
VOLTS/DIV	OFF
MODE	A

2-9. DC BAL ADJUSTMENTS

(Channel A: R9200 and R9202)
(Channel B: R9300 and R9303)

If the dc balance of the Type 76-02 Amplifier is not properly adjusted, the reference trace on the screen will be depositioned when the VARIABLE control is rotated. To properly adjust, proceed as follows:

1. Set Channel A VOLTS/DIV switch to 10 and rotate VARIABLE control fully counterclockwise.

2. Set the front-panel screwdriver controls as follows: DC BAL control to center of its range and GAIN control to position of maximum gain.

3. Adjust the appropriate Time Base Plug-in controls to obtain a reference trace on the screen.

4. Using the POSITION control on the Y Plug-in, position the trace to screen center.

5. Adjust the COARSE DC BAL potentiometer, R9200, to the point where there is no depositioning of the trace when the VARIABLE control is rotated back and forth throughout its range. Trim up this adjustment with the front-panel Fine DC BAL control.

6. Set MODE switch to B and repeat above procedure for Channel B.

2-10. A & B GAIN ADJ (R9226 & R9326)

Whenever the Type 76-02 Amplifier is removed from the Main Frame and inserted in another, the front-panel screwdriver GAIN ADJ controls must be reset. To properly normalize the gain between channels or between the Plug-in Unit and the Main Frame, proceed as follows:

1. Set MODE switch to A.

2. Set Channel A VOLTS/DIV switch to CAL and turn the VARIABLE control to CAL.

3. Set the front-panel screwdriver GAIN ADJ control for precisely 4 divisions (cm) of deflection.

4. Set MODE switch to B and repeat procedure for Channel B.

2-11. HIGH FREQUENCY TRIMMER ADJUSTMENTS (C9207, C9211, C9307, C9311, C9406 & C9415)

1. Apply the output from a Tektronix Type 107 Square Wave Generator through a 93-ohm termination, then through a General Radio 20-db pad, and finally through a 50-ohm cable terminated in 50 ohms (Du Mont Type 4285) to the INPUT A connector of the Y Plug-in Unit.

2. Set MODE switch to A, AC/DC slide switch to AC, VOLTS/DIV switch to 0.005, and the VARIABLE control to CAL.

3. Set frequency range of the Square Wave Generator to 1 megacycle and adjust its output to give 4 centimeters of vertical deflection.

NOTE: Always position the square-wave display within ±1 centimeter of screen center.

4. Adjust the four trimmer capacitors, C9207, C9211, C9406, and C9415 for the best flat-top square wave; ignore the bottom portion of this waveform.

5. Set MODE switch to B and repeat above procedure for Channel B.

NOTE: Do not reset trimmers C9406 and C9415 unless it is necessary. If these trimmers do have to be readjusted, work back and forth between Channels A and B until best compromise is attained.

6. When these adjustments have been made, a small step or notch of about 0.4 microsecond from the start of the trace may be noticed. This step is due to misalignment of the Type 7001 Delay Line termination (if one is used). To minimize this notch when the Delay Line is installed, proceed to steps 7 through 9. If it is not installed, stop procedure at step 6.

7. Interchange the position of the X and Y Plug-in Units. These units must be contained within the Main Frame before making the delay line termination adjustment. When these Plug-in Units are interchanged, the DELAY LINE TERM ADJ potentiometer, R3, will now be accessible.

8. Adjust the DELAY LINE TERM ADJ potentiometer to minimize the notch at 0.4 miscrosecond from the start of the trace.

9. Restore the Plug-ins to their normal positions and retouch the four trimmer capacitors as in step 4.

2-12. TRIG DC LEVEL (R9503)

1. With no signal input, adjust the oscilloscope to obtain a trace on the screen.

2. Connect a voltmeter across pins 1 and 17 of P9001 and adjust the Y POSITION control for an indicated reading of zero volts.

3. Transfer the voltmeter leads to pin 25 of P9001 and ground.

4. Adjust the TRIG DC LEVEL potentiometer, R9503, for an indicated reading of zero volts. The internal trigger pickoff level is now properly adjusted.

2-13. INPUT CAPACITANCE STANDARDIZATION AND ATTENUATOR ADJUSTMENT

The attenuators are factory aligned and should not be touched unless there is positive indication that they require adjustment. If adjustment is necessary, follow the steps as outlined, making reference to Table 2-1 and Figure 2-4.

The input capacitance standardization and attenuator adjustments are interdependent, therefore both tests must be performed in the same procedure. The need for readjustment is normally indicated by distortion of fast-rising waveforms on one or more of the most sensitive ranges of this Plug-in Unit.

Standardization of the input capacitance of this Y Plug-in Unit requires the use of a 42-picofarad capacitance standardizer. To properly adjust the input capacitance and the attenuators of this Plug-in Unit, proceed as follows:

1. Interchange the positions of the X & Y Plug-in. This procedure is required to gain access to the trimmers.

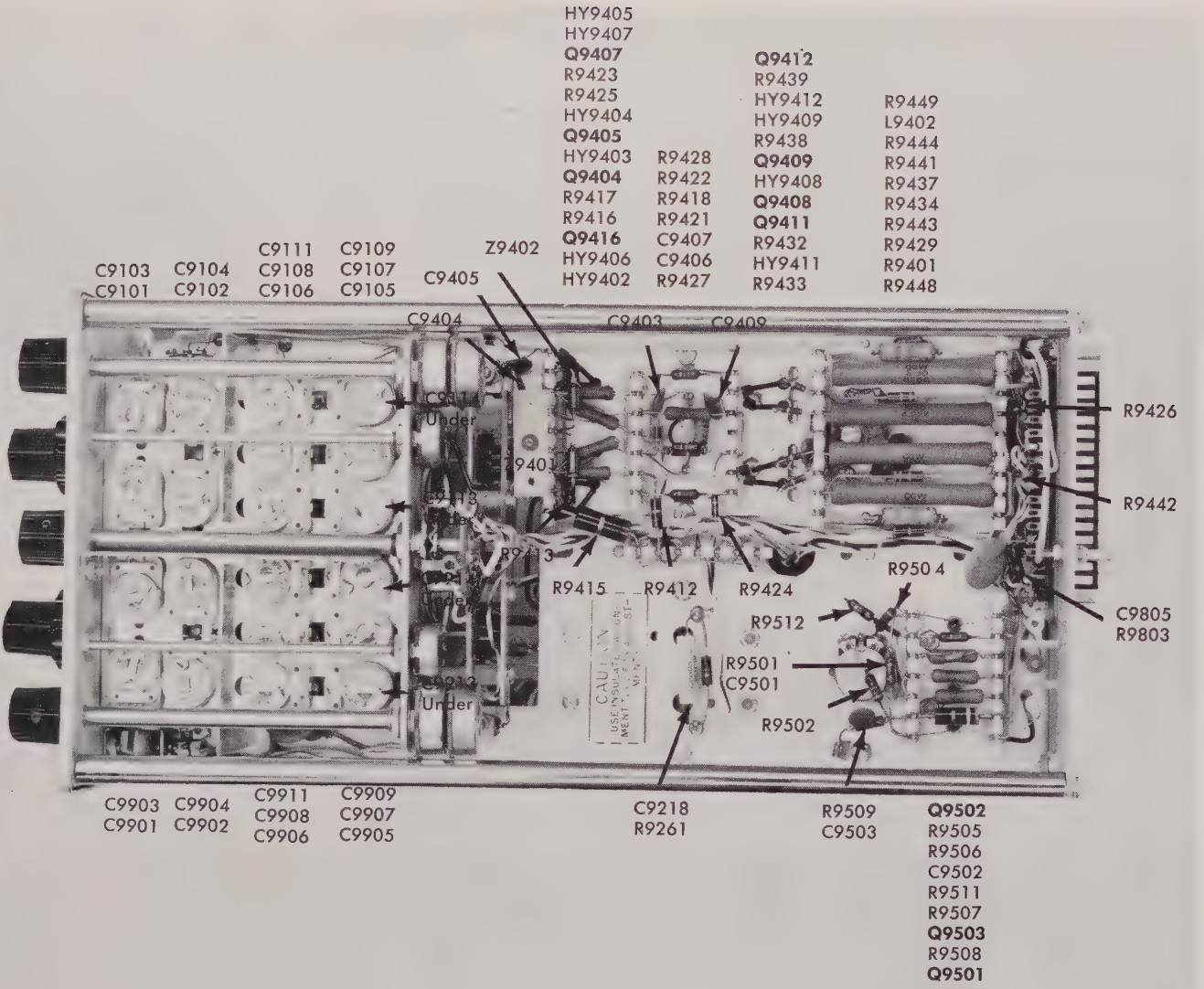


FIGURE 2-4. IDENTIFICATION OF REPLACEABLE PARTS (RIGHT SIDE VIEW)

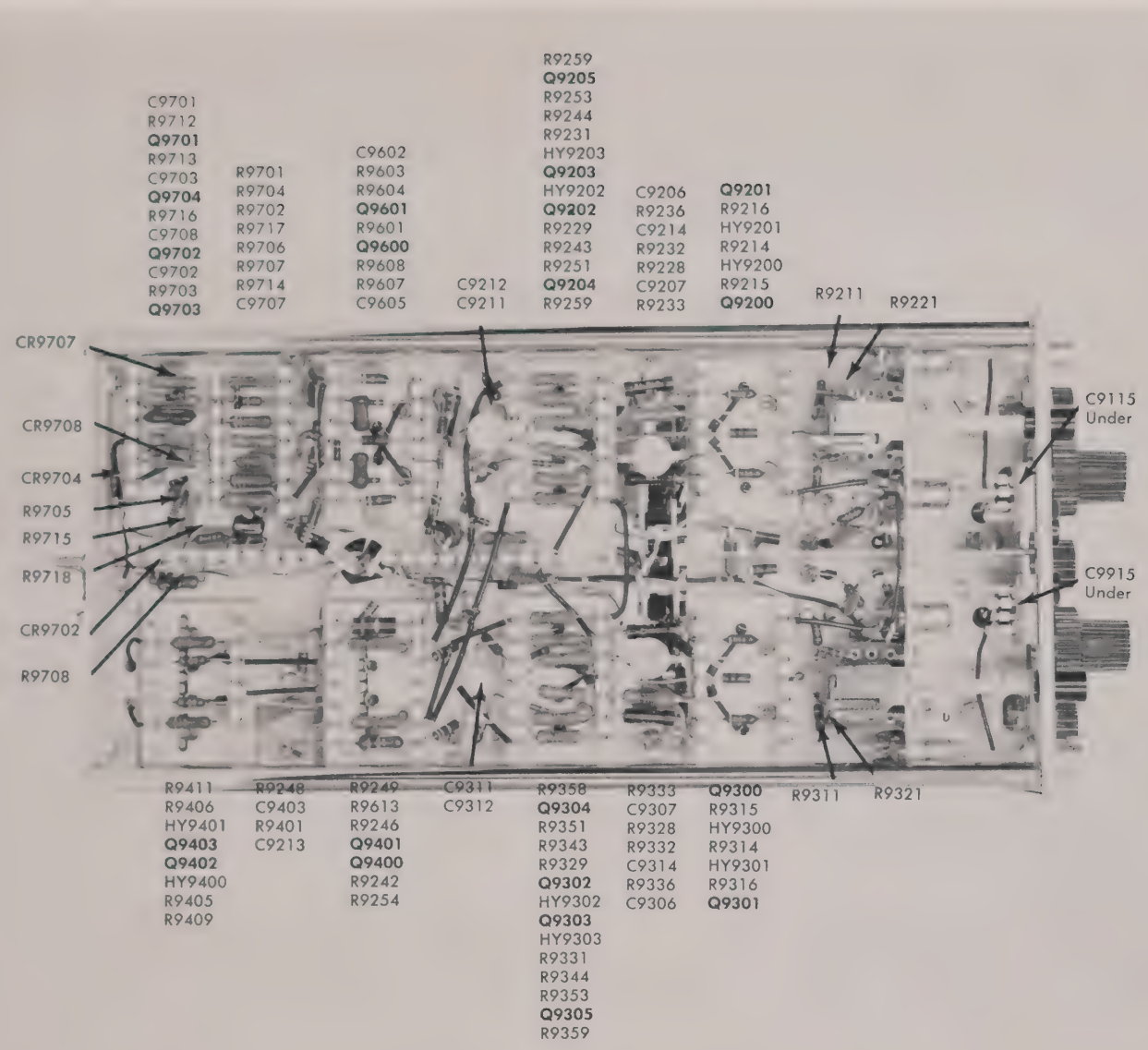


FIGURE 2-5a. IDENTIFICATION OF REPLACEABLE PARTS (LEFT SIDE VIEW)

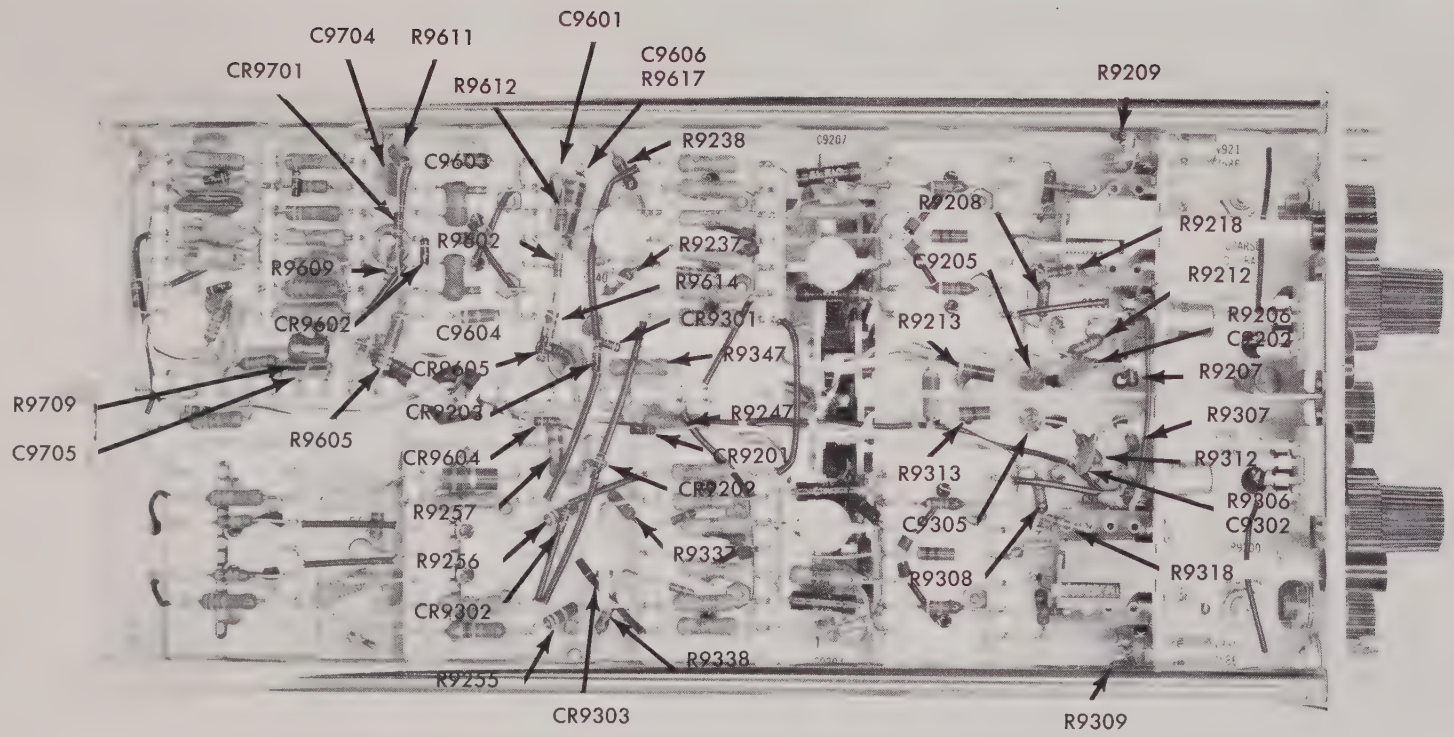


FIGURE 2-5b. IDENTIFICATION OF REPLACEABLE PARTS (LEFT SIDE VIEW)

SECTION 3
PERFORMANCE ASSURANCE TEST

3-1. MAINTENANCE CHECK TO ASSURE PERFORMANCE

The test described in the paragraphs to follow should be performed by Instrument Test Departments and Maintenance Laboratories to certify proper performance. These tests are divided into sections for simplification and to assist those test groups where complete checking is not mandatory, or where all test equipment is not available.

3-2. TEST EQUIPMENT REQUIRED (Equivalent may be substituted)

Type	Description
Sine-Wave Generator	Tektronix Type 190B Constant Amplitude Signal Generator
Termination, 50-ohm	Du Mont Type 4285 and with 50-ohm cable, RG8A/U
Fast Rise Pulse Generator	Lumatron; or Spencer Kennedy Laboratory Model 503 with ¼-microsecond pulse cable

3-3. CHECKING SENSITIVITY

1. Preset front-panel controls as indicated and allow 5 minutes for warmup.

Control	Setting
VOLTS/DIV	CAL
VARIABLE	CAL
AC/DC	AC
MODE	A or B
TRIG LEVEL	PRESET (Pushed in)
SWEEP MODE	TRIG
TRIGGER SOURCE	LINE
TRIGGER COUPLING	AC
TRIGGER SLOPE	+
SWEEP RATE	5 mSEC
VARIABLE SWEEP RATE	CAL

2. Three cycles of the calibrator pattern should be observed on the screen.

3. Adjust front-panel screwdriver DC BAL control after 5-minute warmup. (If necessary, refer to paragraph entitled: "DC BAL Adjustment," in Section 1 for instructions.)

4. Check range of the front-panel screwdriver GAIN ADJ control. The operator should be able to adjust the amplitude of the display from 3.5 cm to 4.5 cm peak-to-peak.

NOTE

All tests are performed with a representative Type 765 Series Main Frame Oscilloscope and a Time-Base Plug-in. Both of the Plug-in units must be normalized to the Main Frame before starting tests. This is accomplished by adjusting the front-panel screwdriver, SWP CAL and GAIN CAL controls as described in the appropriate Plug-in Instruction Manuals.

If after performing all the tests outlined, the unit does not conform to specifications, the assistance of the local Du Mont Field Engineering representative should be requested.

5. After the range of operation has been checked, set the GAIN ADJ control for a nominal 4 divisions (cm) of def deflection.

3-4. CHECKING FAST RISE

1. Apply the fast-rise mercury-relay pulse from the Spencer Kennedy Laboratory Generator through a Du Mont Type 4285 termination to the INPUT A connector of the Y Plug-in.

2. Set the SWEEP RATE controls on the Time Base Unit for the fastest sweep.

3. If the Type 7001 Delay Line Accessory is installed, set TRIGGER SOURCE switch to INT on the Time Base Unit. Use external cable delay and external triggering if the Type 7001 Accessory is not used.

4. Observe a 20-millivolt peak positive rise on the displayed pulse.

5. The rise time (10% to 90% points) should be 15.5 nanoseconds or less.

3-5. CHECKING BANDWIDTH

1. Set VOLTS DIV switch to 0.005.

2. Set SWEEP MODE switch to RECUR SWP and SWEEP RATE switch to 0.1 μSEC.

3. Apply a 50 Kc signal from a Tektronix Type 190B Constant Amplitude Signal Generator to the Input connector on the Y Plug-in Unit.

4. Use the Plug-in and Generator VARIABLE Gain controls to obtain precisely 4 divisions (cm) of peak-to-peak deflection.

5. Set the frequency of the Signal Generator to 25 megacycles. The sine wave amplitude at this frequency should be a nominal 2.8 cm (range: 2.4 cm to 3.1 cm).

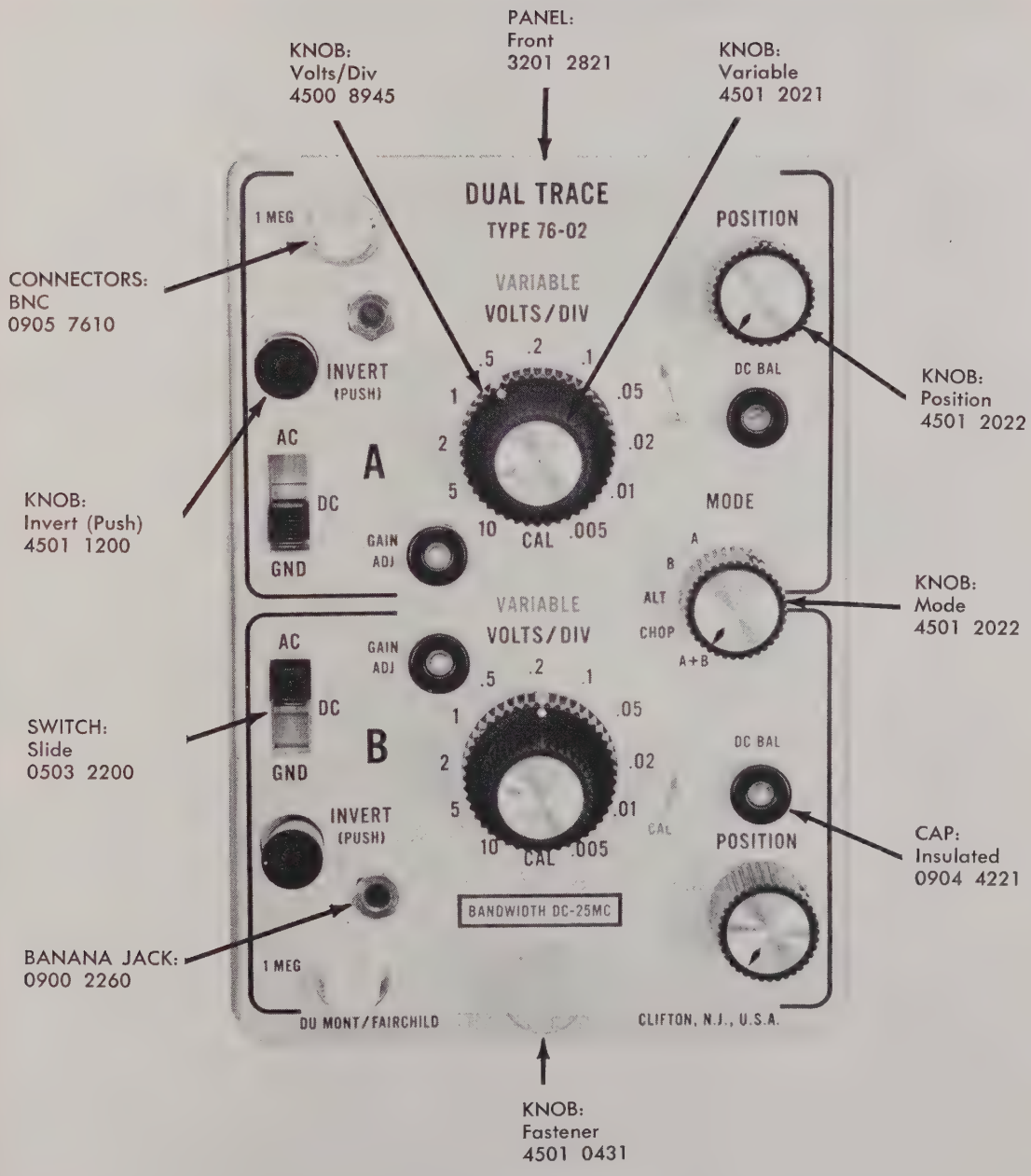


FIGURE 4-1. IDENTIFICATION OF REPLACEABLE PARTS

SECTION 4
ELECTRICAL PARTS LIST AND SCHEMATICS

Symbol	Part Number	Description	Recommended Vendor Code	Type
		CAPACITORS (9100)		
		Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified; pf denotes picofarads. 2. GMV denotes Guaranteed Minimum Value.		
C9101 C9102 & C9103 C9104 &C9105	0300 3040	variable, 3-12 pf	ERC	TS2A-3
	0326 8650	variable, 4-30 pf	ERC	TS2A
C9106	0300 7790	variable, 1.5-7 pf	ERC	NPO-TS2A
C9107	0326 8650	variable, 4-30 pf	ERC	TS2A
C9108	0300 7790	variable, 1.5-7 pf	ERC	NPO-TS2A
C9109	0326 8650	variable, 4-30 pf	ERC	TS2A
C9111	0300 7790	variable, 1.5-7 pf	ERC	NPO-TS2A
C9112	0316 0530	30 pf, ±5%	ERC	
C9113	0326 8700	mica, 250 pf, ±10%	ERC	652-003
C9114	0326 8730	mica, 2400 pf, ±10%	ERC	652-003
C9115	0326 4660	0.02 µf, GMV	ERC	
C9117	0326 4520	1000 pg, GMV	ERC	
		CAPACITORS (9200)		
C9200	0326 7880	plastic, 0.22 µf, ±10%, 125V	AMX	C296AA
C9201 C9202 & C9203	0319 1281	variable, 0.7-3 pf	ABD	
	0319 1060	0.01 µf, +60 —40%, 150V	CRL	DDM
C9205	0319 0450	1000 pf, GMV	SPG	505C
C9206	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9207	0326 9480	variable, 9-35 pf, 200V	ERC	Style 538
C9211	0326 9480	variable, 9-35 pf, 200V	ERC	Style 538
C9212	0315 1530	33 pf, ±10%	ERC	NPO-338
C9213	0326 7860	plastic, 0.1 µf, ±10%, 125V	AMX	C296AA
C9214	0316 3710	12 pf, ±5%, 1000V	RMC	C
C9215	0313 3810	composition, 0.68 pf, ±10%	STC	GA
C9218	0326 5850	plastic, 0.047 µf, ±20%, 150V	GUD	No. 355Y
		CAPACITORS (9300)		
C9300	0326 7880	plastic, 0.22 µf, ±10%, 125V	AMX	C296AA
C9301 C9302 & C9303	0319 1281	variable, 0.7-3 pf	ABD	
	0319 1060	0.01 µf, +60 —40%, 150V	CRL	DDM
C9305	0319 0450	1000 pf, GMV	SPG	505C
C9306	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9307	0326 9480	variable, 9-35 pf, 200V	ERC	Style 538
C9311	0326 9480	variable, 9-35 pf, 200V	ERC	Style 538
C9312	0315 1530	33 pf, ±10%	ERC	NPO-338
C9314	0316 3710	12 pf, ±5%, 1000V	RMC	C
C9315	0313 3810	composition, 0.68 pf, ±10%	STC	GA
		CAPACITORS (9400)		
C9401	0319 1060	0.01 µf, +60 —40%, 150V	CRL	DDM
C9403 C9404 & C9405	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
	0319 1060	0.01 µf, +60 —40%, 150V	CRL	DDM
C9406	0326 9480	variable, 9-35 pf, 200V	ERC	Style 538
C9407	0315 3270	18 pf, ±0.5 pf	ERC	NPO-331
C9409 C9411 & C9412	0319 1060	0.01 µf, +60 —40%, 150V	CRL	DDM
	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9415	0326 9480	variable, 9-35 pf, 200V	ERC	Style 538
C9416	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9417	0316 7010	39 pf, ±5%	ERC	NPO-338
C9418	0326 4520	1000 pf, GMV	ERC	

Symbol	Part Number	Description	Recommended Vendor Code	Type
		CAPACITORS (9500)		
C9501	0317 5210	51 pf, ±5%	EMC	DM15
C9502	0313 8110	5.6 pf, ±0.25 pf	EIA	
C9503	0319 1060	0.01 µf, +60 —40%, 150V	CRL	
		CAPACITORS (9600)		
C9601	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9602 C9603 & C9604	0315 1530	33 pf, ±10%	ERC	NPO-338
	0316 7050	51 pf, ±5%	ERC	NPO-338
C9605	0315 1530	33 pf, ±10%	ERC	NPO-338
C9606	0316 9440	470 pf, ±10%, 1000V	RMC	JL
C9607	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
		CAPACITORS (9700)		
C9701	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9702	0317 4250	820 pf, ±20%, 600V	CRL	Cat. #D-6-821
C9703	0316 6560	220 pf, ±10%	ERC	Style GP-331
C9704	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9705	0326 7860	plastic. 0.1 µf, ±10%, 125V	AMX	C296AA
C9706	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9707	0317 5350	mica, 200 pf, ±5%	EMC	DM15
C9708	0319 1050	0.02 µf, +60 —40%, 150V	CRL	DDM
C9709	0315 2000	10 pf, ±20%	EIA	
		CAPACITORS (9800)		
C9801 to C9804	0310 1270	1000 pf, +100 —0%, 1000V	RMC	B
C9805	0318 6230	0.1 µf, +80 —20%, 100V	RMC	BT
		CAPACITORS (9900)		
C9901 C9902 & C9903 C9904 & C9905	0300 3040	variable, 3-12 pf	ERC	TS2A-3
	0326 8650	varaible, 4-30 pf	ERC	TS2A
	0300 3040	variable, 3-12 pf	ERC	TS2A-3
C9906	0300 7790	variable, 1.5-7 pf	ERC	NPO-TS2A
C9907	0326 8650	variable, 4-30 pf	ERC	TS2A
C9908	0300 7790	variable, 1.5-7 pf	ERC	NPO-TS2A
C9909	0326 8650	variable, 4-30 pf	ERC	TS2A
C9911	0300 7790	variable, 1.5-7 pf	ERC	NPO-TS2A
C9912	0316 0530	30 pf, ±5%	ERC	
C9913	0326 8700	mica, 250 pf, ±10%	ERC	652-003
C9914	0326 8730	mica, 2400 pf, ±10%	ERC	652-003
C9915	0326 4660	0.02 µf, GMV	ERC	
C9917	0326 4520	1000 pf. GMV	ERC	
		DELAY LINE		
	*8901 6791	Type 7001	ABD	
		*Depending on sales order.		
		SEMICONDUCTORS		
CR9201 to CR9203	2600 6910	diode, FD841	FCI	
CR9301 to CR9303	2600 6910	diode, FD841	FCI	
CR9602 to CR9605	2600 6910	diode, FD841	FCI	
CR9701 & CR9702	2600 6910	diode, FD841	FCI	
CR9704	2600 6910	diode, FD841	FCI	
CR9707 & CR9708	2600 6910	diode, FD841	FCI	

Symbol	Part Number	Description	Recommended Vendor Code	Type
HYBRID COILS				
HY9200 to HY9203	2110 1560	Bead, ferrite	FER	
HY9300 to HY9303	2110 1560	Bead, ferrite	FER	56-590-65/3B
HY9400 to HY9409	2110 1560	Bead, ferrite	FER	56-590-65/3B
HY9411 & HY9412	2110 1560	Bead, ferrite	FER	56-590-65/3B
ELECTRICAL CONNECTORS				
J9101	0905 7610	receptacle, rf, female, 1 contact, BNC, UG-625A/U	DAG	
J9103	0905 8500	jack, assembly	AMA	Part #403
J9901	0905 7610	receptacle, rf, female, 1 contact, BNC, UG-625A/U	DAG	
J9903	0905 8500	jack, assembly	AMA	Part #403
COILS				
L9201 & L9202	2100 6260	fixed, rf, 1.5 µh, ±10%	IRC	CLA
L9301 & L9302	2100 6260	fixed, rf, 1.5 µh, ±10%	IRC	CLA
L9401 & L9402	2110 1350	fixed, rf, 3.3 µh, ±5%	IRC	CLA
ELECTRICAL CONNECTOR				
P9001	0905 7340	plug, male, 32 contacts	APH	26-159-32
TRANSISTORS				
Q9200 & Q9201	2600 7700 2600 7680	DU #12A alternate 2N709	FCI	
Q9202 to Q9205	2600 2771	DU #2N	FCI	
Q9300 & Q9301	2600 7700 2600 7680	DU #12A alternate 2N709	FCI	
Q9302 to Q9305	2600 2771 2600 7050	DU #2N alternate 2N915	FCI	
Q9400 to Q9405	2600 7060 2600 7050	DU #2 alternate 2N915	FCI	
Q9406 to Q9409	2600 7070 2600 7050	DU #2A alternate 2N915	FCI	
Q9411 & Q9412	2600 7070 2600 7050	DU #2A alternate 2N915	FCI	
Q9501 & Q9502	2600 7060 2600 7050	DU #2 alternate 2N915	FCI	
Q9503	2600 7020 2600 7000	DU #1A alternate 2N914	FCI	
Q9600 & Q9601	2600 7020 2600 7000	DU #1A alternate 2N914	FCI	
Q9701 & Q9702	2600 7020 2600 7000	DU #1A alternate 2N914	FCI	
Q9703	2600 7160 2600 7150	DU #4 alternate 2N1132	FCI	
Q9704	2600 7070 2600 7050	DU #2A	FCI	
Q9600 & Q9601	2600 7020 2600 7000	DU #1A alternate 2N914	FCI	
RESISTORS (9100)				
Note: All resistors are fixed, film, ±5%, ½W, and values in ohms unless otherwise specified; K = thousand, M = million				
R9101	0229 4890	500K, ±1%	TEX	CD1/2PR
R9102	0229 4900	750K, ±1%	TEX	CD1/2PR
R9103	0229 4910	900K, ±1%	TEX	CD1/2PR
R9104	0229 9010	990K, ±1%	TEX	CD1/2PR
R9105 & R9106	0229 4700	1M, ±1%	TEX	CD1/2PR
R9107	0229 9040	333K, ±1%	TEX	CD1/2PR
R9108	0229 9050	111K, ±1%	TEX	CD1/2PR
R9109	0229 9080	10.1K, ±1%	TEX	CD1/2PR
R9111	0229 9170	1K, ±1%	TEX	CD1/2PR
R9116	0229 7000	12.1K, ±1%, ¼W	CGW	N65
R9117	0229 9290	590K, ±1%	TEX	CD1/2PR

Symbol	Part Number	Description	Recommended Vendor Code	Type
RESISTORS (9200)				
R9200	0107 4380	variable, composition, 100K ±20%, .2W (COARSE DC BAL)	CTS	Series 70
R9201	0229 4700	1M, ±1%	TEX	CD½PR
R9202	0109 0360	variable, composition, 100K ±20% (DC BAL)	CTS	Series 70
R9203	0228 5390	2.74M, ±1%	IRC	DCC
R9204	0236 0020	6.2K, ±1%	CGW	NI20
R9205	0234 8010	150	CGW	C-20
R9206	0235 5090	composition, 100K, ¼W	ALB	CB
R9207	0235 6590	composition, 100, ±20%, ¼W	ALB	CB
R9208	0235 9030	750, ±1%	CGW	NI-20
R9209	0235 6590	composition, 100, ±20%, ¼W	ALB	CB
R9210	0229 4700	composition, 1M, ±1%	TEX	CD1/2PR
R9211	0235 9030	750, ±1%	CGW	NI-20
R9212	0236 0390	13K, ±1%	CGW	NI-20
R9213	0203 2340	composition, 47, ±20%	ALB	EB
R9214	0203 2300	composition, 10, ±20%	ALB	EB
R9215 & R9216	0234 8440	9.1K	CGW	C-20
R9218	0235 4310	composition, 51, ¼W	ALB	CB
R9220	0234 8430	8.2K	CGW	C-20
R9221	0235 4310	composition, 51, ¼W	ALB	CB
R9222	0235 5780	composition, 27, ±10%, ¼W	ALB	CB
R9223	0107 2691	variable, composition, 4K, ±20%, ¼W (VARIABLE GAIN)	ABD	
R9224	0235 5780	composition, 27, ±10%, ¼W	ALB	CB
R9225	0235 4330	composition, 62, ¼W	ALB	CB
R9226	0107 2652	variable, composition, 4K, ±10%, ¼W (GAIN ADJ)	ABD	
R9227	0235 4330	composition, 62, ¼W	ALB	CB
R9228	0236 0100	7.5K, ±1%	CGW	NI-20
R9229	0236 0580	20K, ±1%	CGW	NI-20
R9231	0236 0580	20K, ±1%	CGW	NI-20
R9232	0236 0100	7.5K, ±1%	CGW	NI-20
R9233	0223 3700	1M	CGW	NF60
R9234	0109 1060	variable, composition 100K/100K, ±20% (POSITION)	CTS	Series 245
R9236 & R9237	0223 3700	1M	CGW	NF60
R9238	0234 8450	10K	CGW	C-20
R9241	0203 1840	composition, 3.9K, ±10%	ALB	EB
R9242	0235 9650	2.74K, ±1%	CGW	NI-20
R9243 & R9244	0235 8500	221, ±1%	CGW	NI-20
R9246	0235 9650	2.74K, ±1%	CGW	NI-20
R9247	0236 0520	17.4K, #1%	CGW	NI-20
R9248	0235 9500	2K, ±1%	CGW	NI-20
R9249	0203 2400	composition, 470, ±20%	ALB	EB
R9251	0235 5780	composition, 27, ±10%, ¼W	ALB	CB
R9253	0235 5780	composition, 27, ±10%,¼W	ALB	CB
R9254	0234 9640	300K, 1W	CGW	C-32
R9255 & R9256	0203 2190	composition, 3.3M, ±10%	ALB	EB
R9257	0234 9640	composition, 300K, 1W	CGW	C-32
R9258 & R9259	0236 1620	200K, ±1%	CGW	NI-20
R9261	0203 1480	composition, 15M	ALB	EB
RESISTORS (9300)				
R9300	0107 4380	variable, composition, 100K, ±20%, .2W (COARSE DC BAL)	CTS	Series 70
R9301	0229 4700	1M, ±1%	TEX	CD½PR
R9302	0109 0360	variable, composition, 100K, ±20% (DC BAL)	CTS	Series 70
R9303	0228 5390	2.74M, ±1%	IRC	DCC
R9304	0236 0020	6.2K, ±1%	CGW	NI20
R9305	0234 8010	150	CGW	C-20
R9306	0235 5090	composition, 100K, ¼W	ALB	CB
R9307	0235 6590	composition, 100, ±20%, ¼W	ALB	CB
R9308	0235 9030	750, ±1%	CGW	NI-20
R9309	0235 6590	composition, 100, ±20%, ¼W	ALB	CB
R9310	0229 4700	1M, ±1%	TEX	CD1/2PR
R9311	0235 9030	750, ±1%	CGW	NI-20
R9312	0236 0390	13K, ±1%	CGW	NI-20
R9313	0203 2340	composition, 47, ±20%	ALB	EB
R9314	0203 2300	composition, 10, ±20%	ALB	EB
R9315 & R9316	0234 8440	9.1K	CGW	C-20
R9318	0235 4310	composition, 51, ¼W	ALB	CB

Symbol	Part Number	Description	Recommended Vendor Code	Type
R9320	0234 8430	8.2K	CGW	C-20
R9321	0235 4310	composition, 51, ¼W	ALB	CB
R9322	0235 5780	composition, 27, ±10%, ¼W	ALB	CB
R9323	0107 2691	variable, composition, 4K, ±20%, ¼W (VARIABLE GAIN)	ABD	
R9324	0235 5780	composition, 27, ±10%, ¼W	ALB	CB
R9325	0235 4330	composition, 62, ¼W	ALB	CB
R9326	0107 2652	variable, composition, 4K, ±10%, ¼W (GAIN ADJ)	ABD	
R9327	0235 4330	composition, 62, ¼W	ALB	CB
R9328	0236 0100	7.5K, ±1%	CGW	NI-20
R9329	0236 0580	20K, ±1%	CGW	NI-20
R9331	0236 0580	20K, ±1%	CGW	NI-20
R9332	0236 0100	7.5K, ±1%	CGW	NI-20
R9333	0223 3700	1M	CGW	NF60
R9334	0109 1060	variable, composition, 100K/100K, ±20% (POSITION)	CTS	Series 245
R9336	0223 3700	1M	CGW	NF60
R9337 & R9338	0234 8450	10K	CGW	C-20
R9341	0203 1840	composition, 3.9K, ±10%	ALB	EB
R9343 & R9344	0235 8500	221, ±1%	CGW	NI-20
R9347	0236 0520	17.4K, ±1%	CGW	NI-20
R9351	0235 5780	composition, 27, ±10%, ¼W		
R9353	0235 5780	composition, 27, ±10%, ¼W	ALB	CB
R9358 & R9359	0236 1620	200K, ±1%	CGW	NI-20

RESISTORS (9400)

R9401	0203 1580	composition, 27, ±10%	ALB	EB
R9405 & 9406	0234 8450	10K	CGW	C-20
R9409	0234 9150	2.7K, 1W	CGW	C-32
R9411	0234 9150	2.7K, 1W	CGW	C-32
R9412	0203 1580	composition, 27, ±10%	ALB	EB
R9413 & R9414	0235 8210	110, ±1%	CGW	NI-20
R9415	0203 6480	composition, 1K, 2W	ALB	HB
R9416	0235 9640	2.7K, ±1%	CGW	NI-20
R9417 & R9418	0236 0930	42.2K, ±1%	CGW	NI-20
R9421	0234 5750	422, ±1%, ⅛W	CGW	NF60
R9422	0236 0930	42.2K, ±1%	CGW	NI-20
R9423	0235 9640	2.7K, ±1%	CGW	NI-20
R9424	0235 5780	composition, 27, ±10%, ¼W	ALB	EB
R9425	0236 0930	42.2K, ±1%	CGW	NI-20
R9426	0235 5730	composition, 10, ±10%, ¼W	ALB	EB
R9427 & R9428	0234 9170	3.3K, 1W	CGW	C-32
R9429	0230 4150	825, ±1%, 4W	CGW	SI-30
R9432 & 9433	0235 5730	composition, 10, ±10%, ¼W	ALB	CB
R9434	0230 4120	4.22K, ±1%, 4W	CGW	SI-30
R9436	0235 8500	221, ±1%	CGW	NI-20
R9437	0230 4120	4.22K, ±1%, 4W	CGW	SI-30
R9438 & R9439	0235 5730	composition, 10, ±10%, ¼W	ALB	CB
R9441	0230 4150	825, ±1%, 4W	CGW	SI-30
R9442	0235 5730	composition, 10, ±10%, ¼W	ALB	CB
R9443 & R9444	0203 2190	composition, 3.3M, ±10%	ALB	EB
R9445	0235 4960	composition, 30K, ¼W	ALB	CB
R9446	0234 8510	18K, ±1%	CGW	C-20
R9447	0234 8560	30K, ±1%	CGW	C-20
R9448 & R9449	0234 8190	820	CGW	C-20

RESISTORS (9500)

R9501	0234 8150	560	CGW	C-20
R9502	0234 8600	43K	CGW	C-20
R9503	0106 3360	variable, composition, 25K, ±10% (TRIG DC LEVEL)	CTS	Series 65
R9504	0234 8600	43K	CGW	C-20
R9505	0234 8400	6.2K		
R9506	0236 1020	51.1K, ±1%	CGW	NI-20
R9507	0234 8730	150K	CGW	C-20
R9508	0203 3620	composition, 3.9K, 1W	ALB	
R9509	0203 0550	composition, 2K, ±1%	ALB	EB
R9511	0236 0270	10K, ±1%	CGW	NI-20
R9512	0234 8500	16K	CGW	C-20
R9513	0236 1180	73.2K, ±1%	CGW	NI-20

RESISTORS (9600)

R9601	0203 2300	composition, 10, ±20%	ALB	EB
R9602	0203 3550	composition, 2K, 1W	ALB	GB
R9603	0203 0630	composition, 4.3K	ALB	EB
R9604	0235 4680	composition, 2K, ¼W	ALB	CB
R9605	0203 0870	composition, 43K	ALB	EB
R9606	0203 0760	composition, 15K	ALB	EB
R9607	0203 0630	composition, 4.3K	ALB	EB
R9608	0235 4680	composition, 2K, ¼W	ALB	CB
R9609	0203 0870	composition, 43K	ALB	EB
R9611	0203 0760	composition, 15K	ALB	EB
R9612	0203 3550	composition, 2K, 1W	ALB	GB
R9613	0203 3580	composition, 2.7K, 1W	ALB	GB
R9614	0203 0390	composition, 430	ALB	EB
R9617	0203 3370	composition, 360, 11W	ALB	GB

RESISTORS (9700)

R9701	0235 1480	6.81K, ±1%	CGW	NI-20
R9702	0234 9170	3.3K, 1W	CGW	C-32
R9703	0234 8430	8.2K	CGW	C-20
R9704	0234 8630	56K	CGW	C-20
R9705	0234 8570	33K	CGW	C-20
R9706	0234 8630	56K	CGW	C-20
R9707	0234 9170	3.3K, 1W	CGW	C-32
R9708	0234 9110	1.8K, 1W	CGW	C-32
R9709	0203 0070	composition, 20	ALB	EB
R9710	0235 4310	composition, 51, ¼W	ALB	CB
R9711	0203 1530	composition, 10, ±10%	ALB	EB
R9712	0235 9190	976, ±1%	CGW	NI-20
R9713	0234 8430	8.2K	CGW	C-20
R9714	0235 9970	5.62K, ±1%	CGW	NI-20
R9715	0236 0470	15.8K, ±1%	CGW	NI-20
R9716	0236 0510	16.9K, ±1%	CGW	NI-20
R9717	0235 1580	8.45K, ±1%		
R9718	0234 8340	3.6K	CGW	C-20
R9719	0235 9600	2.49K, ±1%	CGW	NI20
R9720	0203 0530	Composition, 1.6K	ALB	EB
R9721	0236 0690	24.9K, ±1%	CGW	NI20

RESISTORS (9800)

R9801 & R9802	0239 1359	430, 2W	ABD	
R9803	0203 0070	composition, 20	ALB	EB
R9804	0234 8260	1.6K	CGW	C-20

RESISTORS (9900)

R9901	0229 4890	500K, ±1%	TEX	CD1/2PR
R9902	0229 4900	750K, ±1%	TEX	CD1/2PR
R9903	0229 4910	900K, ±1%	TEX	CD1/2PR
R9904	0229 9010	990K, ±1%	TEX	CD1/2PR
R9905 & R9906	0229 4700	1M, ±1%	TEX	CD1/2PR
R9907	0229 9040	333K, ±1%	TEX	CD1/2PR
R9908	0229 9050	111K, ±1%	TEX	CD1/2PR
R9909	0229 9080	10.1K, ±1%	TEX	CD1/2PR
R9911	0229 9170	1K, ±1%	TEX	CD1/2PR
R9915	0203 0000	composition, 10	ALB	EB
R9916	0229 7000	12.1K, ±1%, ¼W	CGW	N65
R9917	0229 9290	590K, ±1%	TEX	CD1 2PR

SWITCHES

S910	0501 6822	rotary, 5 sections, 12 positions (VOLTS/DIV)	ABD	
S911	0503 2200	slide, 3 positions (AC/DC - GND)	STC	SS-31
S920	0501 6861	push-push (INVERT)	ABD	
S930	0501 6861	push-push (INVERT)	ABD	
S960	0501 6831	rotary, 1 section, 5 positions (MODE)	ABD	
S990	0501 6822	rotary, 5 sections, 12 positions (VOLTS DIV)	ABD	
S991	0503 2200	slide, 3 positions (AC/DC - GND)	STC	SS-31

ELECTRON TUBES

V920 & V921	2501 3430	7586	RCA	Nuvistor
V930 & V931	2501 3430	7586	RCA	Nuvistor

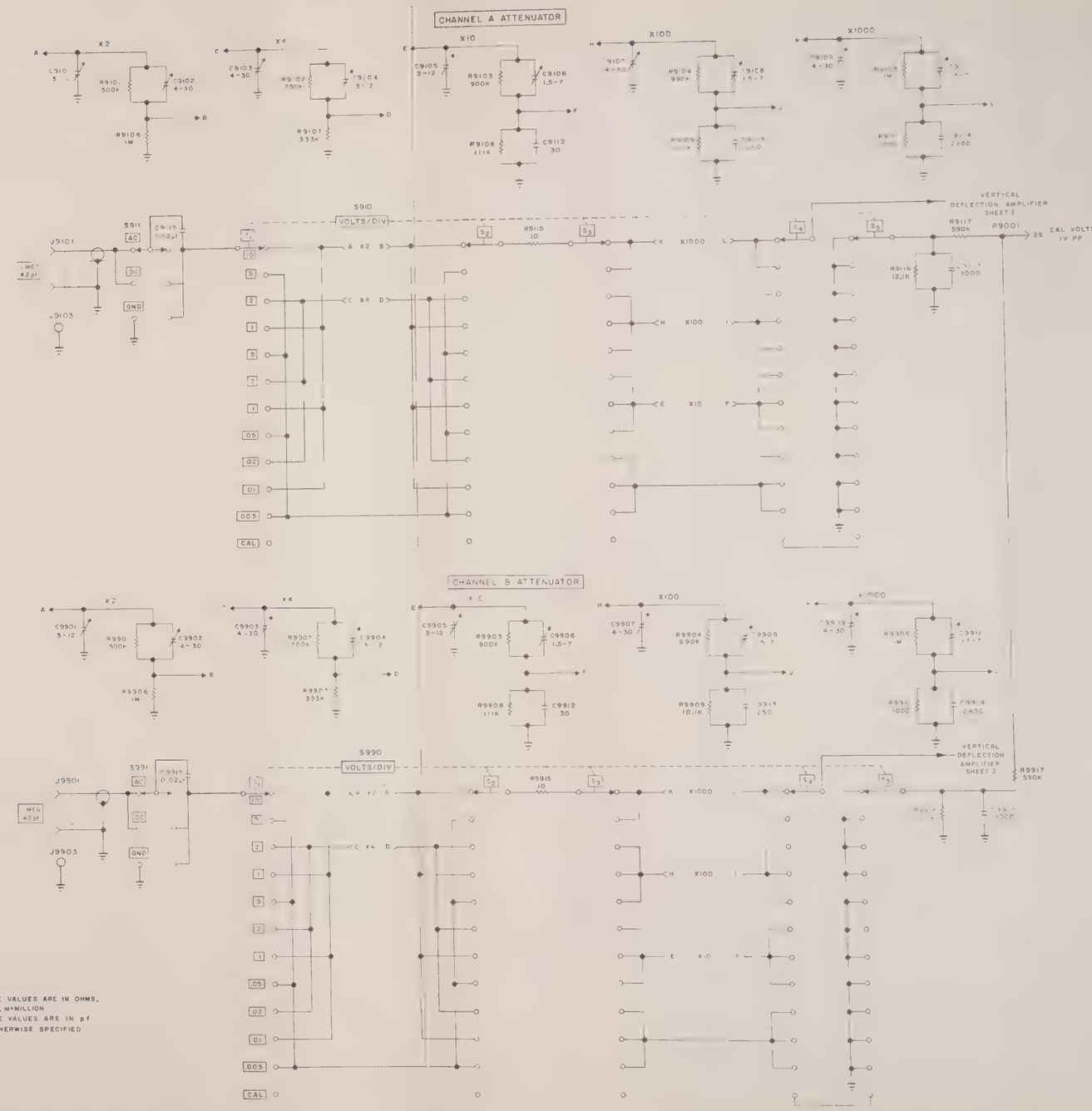
NETWORKS

Z9401 & Z9402	8800 2335	peaking	ABD	

LIST OF RECOMMENDED VENDORS

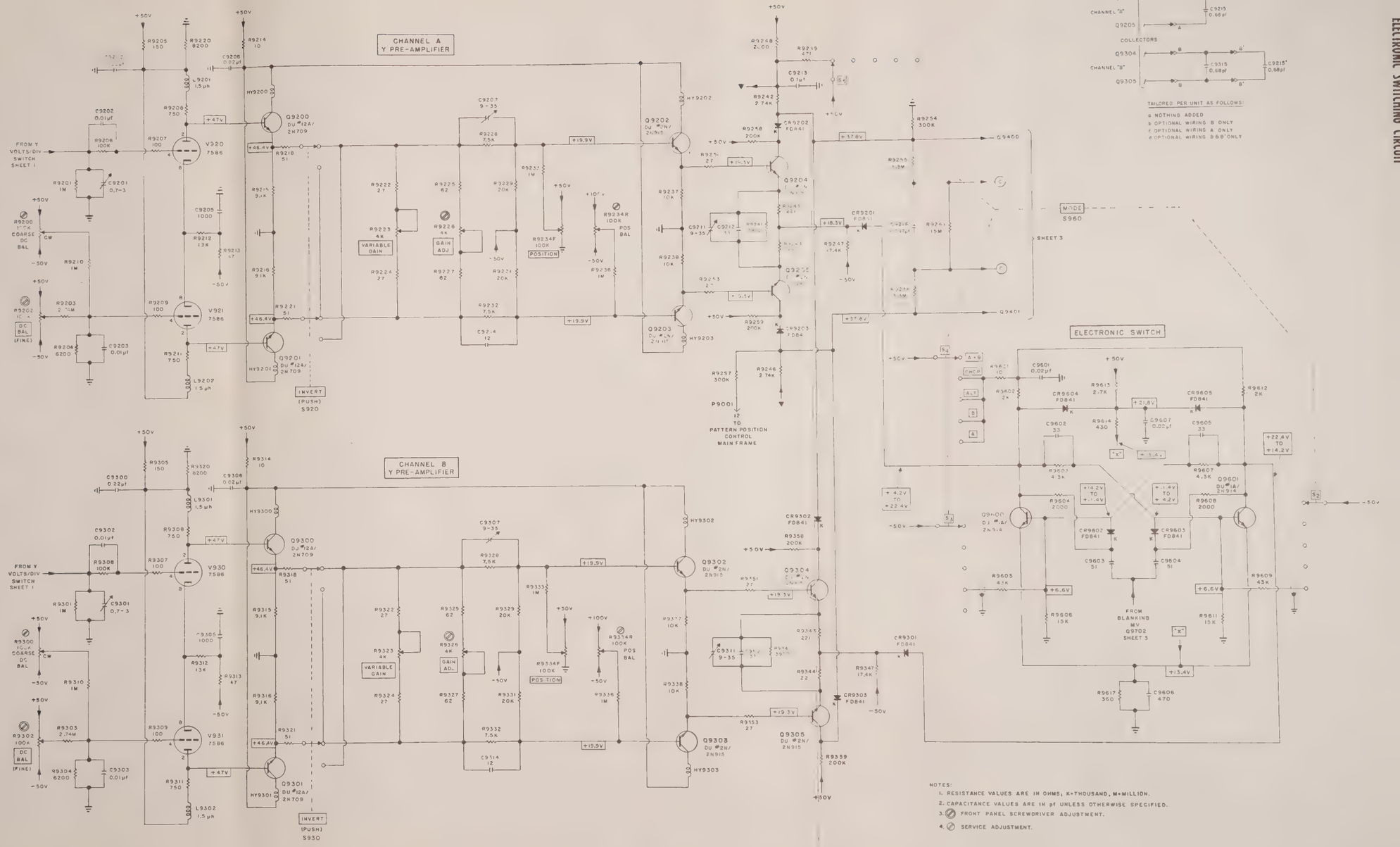
CODE	NAME
ABD	Allen B. Du Mont Laboratories
AER	Aerovox Corporation
AHH	Arrow-Hart & Hegeman Electric Company
ALB	Allen-Bradley Company
ALC	Allied Control
ALD	Alden Products Company
AMA	Amaton Electronic Hardware
AMP	Amp Inc.
AMR	Amperite Company, Inc.
AMX	Amperex Electronic Products, Inc.
APC	American Phenolic Corporation
APH	Amphenol Electronics Corporation
ARC	Arco-Elemenco
AST	Astron Corporation
BUS	Bussmann Mfg. Co.
CAN	Cannon Electric Company
CBS	CBS-Hytron Division of CBS
CGW	Corning Glass Works
CH	Cutler-Hammer, Inc.
CHC	Chester Cable Corporation
CHM	Chatham Electronics
CLS	Clarostat Mfg. Co., Inc.
CDE	Cornell-Dubilier Electric Corporation
COC	Continental Carbon
CPC	C. P. Clare & Company
CRL	Centralab, Division of Globe-Union Inc.
CST	Chicago Standard Transformer
CTS	Chicago Telephone Supply Corporation
DAG	Dage Electric Company, Inc.
DAL	Dale Products, Inc.
DLC	Dialight Corporation
DRK	Drake Mfg. Co.
EBY	Hugh H. Eby, Inc.
EIA	Any manufacturer meeting EIA standards
ELC	Electra Mfg. Company
ELD	Eldema Corporation
ELM	Elmenco
EMC	Electro Motive Mfg. Company
EMW	Elmwood Sensors, Inc.
ER	Eastern Radio
ERC	Erie Resistor Corporation
ESX	Essex Electronics
FCI	Fairchild Camera and Instrument Corporation
FER	Ferroxcube Corporation of America
GE	General Electric Company
GRC	General Radio Company
GRY	Grayhill, Inc.

CODE	NAME
GUD	The Gudeman Company
HOP	Hopkins Engineering Company
HWP	Hewlett-Packard Company
IRC	International Resistance Company
IRP	International Rectifier Corporation
ITT	ITT Components Division
JEF	Jeffers Electronics, Inc.
JHN	E. F. Johnson Company
JWM	J. W. Miller Co.
KUL	Kulka Electric Mfg. Co. Inc.
KXM	Klixon Metals and Control Corporation
LFI	Littlefuse, Inc.
MAL	P. R. Mallory & Company, Inc.
MIC	Micamold Electronics Mfg. Corporation
MIL	Miller Electric Company
MUT	The Muter Company
NYT	New York Transformer Company, Inc.
OAK	Oak Mfg. Company
PHC	Philco Corporation
PHI	Philips Electronic Tube Division
PLS	Plastoid Corporation
POT	Potter & Brumfield, Inc.
PRC	Precision Resistor Co., Inc.
PYR	Pyramid Electric Company
RCA	Radio Corporation of America
RMC	Radio Materials Corporation
ROY	Royal Electric Corp., Inc.
RTN	Rotron Mfg. Company
SLT	Sealectro Corporation
SPG	Sprague Electric Company
STC	Stackpole Carbon Company
STW	Standard Winding Company
SUM	Summit Coil Company
SYL	Sylvania Electric Products, Inc.
SYN	Synstronic Instruments, Inc.
TEC	Transistor Electronics Corporation
TEX	Texas Instruments, Inc.
THC	Thermol Control, Inc.
TOR	Torrington Mfg. Company
TRS	Tresco, Inc.
TRU	Tru-Ohm Products
TUG	Tung-Sol Electric Inc.
UCN	Ucinite Co.
VIC	The Victoreen Instrument Company
WDL	Ward Leonard Electric Company
WES	Weston Electrical Instrument Corporation
WYN	Welwyn International Inc.

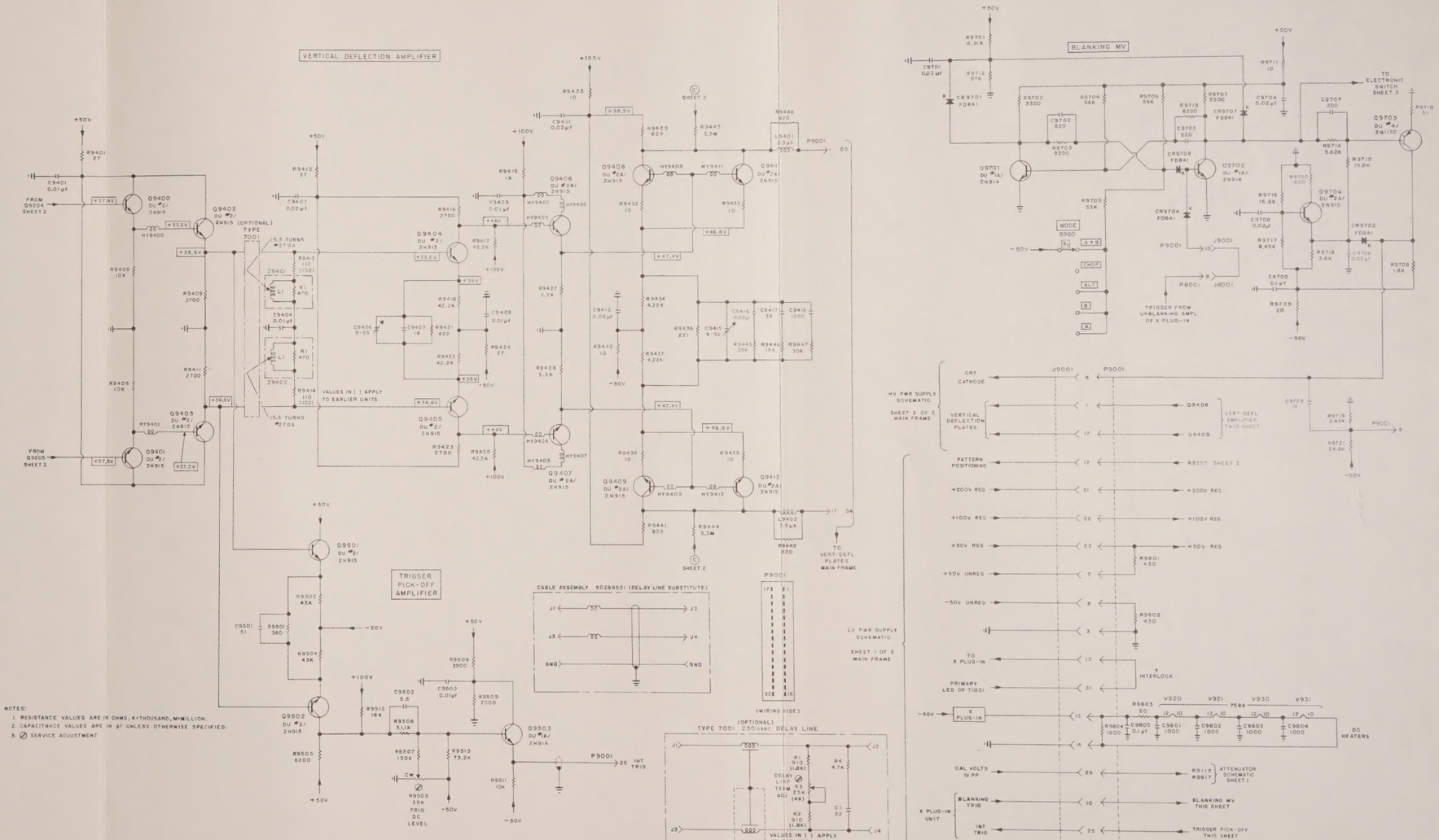


NOTES

1. RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED



ELECTRONIC SWITCHING CIRCUIT


VERTICAL DEFLECTION AMPLIFIER
BLANKING MV
TRIGGER PICK-OFF AMPLIFIER
CABLE ASSEMBLY 502B52I (DELAY LINE SUBSTITUTE)
(OPTIONAL) TYPE 7001 230nsec DELAY LINE
TYPE 7001 (OPTIONAL)
VALUES IN [ ] APPLY TO EARLIER UNITS
TRIGGER FROM UNBLANKING AMPL OF X PLUG-IN
TO ELECTRONIC SWITCH SHEET 2
TO VERT DEFL PLATES MAIN FRAME
FROM Q9204 SHEET 2
FROM Q9205 SHEET 2
MV PWR SUPPLY SCHEMATIC SHEET 2 OF 2 MAIN FRAME
LV PWR SUPPLY SCHEMATIC SHEET 1 OF 2 MAIN FRAME
ATTENUATOR SCHEMATIC SHEET 1
VERT DEFL AMPLIFIER THIS SHEET
BLANKING MV THIS SHEET
TRIGGER PICK-OFF THIS SHEET
DC HEATERS
X PLUG-IN UNIT
CRT CATHODE
VERTICAL DEFLECTION PLATES
PATTERN POSITIONING
+200V REG
+100V REG
+50V REG
+50V UNREG
-50V UNREG
TO X PLUG-IN
PRIMARY LEG OF T1001
Y INTERLOCK
X PLUG-IN
CAL VOLTS IV PP
BLANKING TRIG
INT TRIG
-50V REG
Q9400 DU #2/ 2N915
Q9401 DU #2/ 2N915
Q9402 DU #2/ 2N915
Q9403 DU #2/ 2N915
Q9404 DU #2/ 2N915
Q9405 DU #2/ 2N915
Q9406 DU #2A/ 2N915
Q9407 DU #2A/ 2N915
Q9408 DU #2A/ 2N915
Q9409 DU #2A/ 2N915
Q9411 DU #2A/ 2N915
Q9412 DU #2A/ 2N915
Q9501 DU #2/ 2N915
Q9502 DU #2/ 2N915
Q9503 DU #4/ 2N914
Q9701 DU #1A/ 2N914
Q9702 DU #1A/ 2N914
Q9703 DU #4/ 2N1132
Q9704 DU #2A/ 2N915
HY9400
HY9401
HY9403
HY9404
HY9405
HY9406
HY9407
HY9408
HY9409
HY9411
HY9412
P9001
J9001
L9401 33μh
L9402 1.3μh
L9403 33μh
T9401
T9402
MODE SWITCH 5960
CHOP
ALT
A
B
A+B
NOTES:
1. RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED.
3. ⊘ SERVICE ADJUSTMENT

PRONG FASTENER
BINDER

GENUINE PRESSBOARD

USE Fellows PRONG FASTENER

TO DUPLICATE REFER TO NUMBER

450-13

(C & C RSH-257)

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